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"I cannot help plead to my countrymen, at every opportunity, to cherish all that is manly and noble in the military profession, because Peace is enervating and no man is wise enough to foretell when soldiers may be in demand again."—SHERMAN.

VOL. XXIII. JULY, 1898. NO. XCIV.

REPLY TO GENERAL PORTER'S ARTICLES WHICH HAVE APPEARED IN THE CENTURY MAGAZINE DURING THE YEARS 1896 AND 1897.

BY LIEUT.-COL. H. H. HUMPHRIES, 12TH U. S. INFANTRY.

GENERAL PORTER, in the *Century Magazine* for May, 1897, quotes General Meade's Chief of Staff as saying of General Grant's instructions for that army, "there was no misunderstanding their meaning." Therefore, General Porter will not object to the publication of the carefully-prepared instructions of this Chief of Staff, issued on the receipt of dispatches from the Commanding General, directing the forward movements of that army, towards the positions then held by the Confederates. There must be at all times a thorough understanding of what these dispatches (those of the Commander-in-chief) say or direct to be done, before we can properly comprehend the preparation of the projects which require the doing of it. Nor will General Porter refuse to accept what this Chief of Staff of the Army of the Potomac states concerning the many incidents which occurred in the Army of the Potomac during the campaigns in Virginia in the years 1864 and 1865.

The position of the Chief of Staff is one of great responsibility, involving a perfect knowledge of all the many details which concern the welfare of an army; not only of its health, but of its condition for fighting; a thorough knowledge specifi-

cally of the country about to be operated in, besides the preparation of special instructions for every movement of an army, the carrying out of which, if well planned, and well fought, insures the success of a campaign. There are many other details, of which the Chief of Staff must have information, too numerous to mention, and of which the general reader will not care to be burdened with; besides, their citation does not properly belong to this article.

The gentleman of whom I write, when living, was known as a man of science, as a man of letters, and a soldier of the first class.

Of the enormous responsibilities which fell upon the Commander-in-chief, in the proper direction of his many armies, over a vast area of country toward their objectives; of their condition and readiness for forward movements; of the plans general in character, which must and did emanate from him; the personal magnetism which he possessed, which is shown in his dispatches; of the checks which his plans might meet, and of their resolution; the incessant and pitiless stream of telegrams, letters, which daily poured in upon him, giving information, asking for information, telling of success or disaster; of the daily personal interviews with the Commander of the Army of the Potomac and with its corps commanders; the personal inspection of the lines of battles, the incessant care and watchfulness on his part, that none of his units went astray, or were thwarted in the general scheme for the suppression of the Rebellion. Yet with all this, the general reader would draw from the perusal of these articles, General Grant still found time to specifically and minutely devise plans for each and every move of the army which he accompanied in the field. If such be the case, and the writer of this article does not believe it to be so, then operations for the Army of the Potomac were conducted on a different plan than those followed by European armies, where the position and duties of a Chief of Staff are clearly defined. Neither do we know of a single instance wherein this Chief of Staff failed in his duties; but, on the contrary, recognition of his abilities, for he was to be assigned to the command of a corps in that army, in the event of certain contingencies happening. There is also a personal appeal of the Lieutenant-General, addressed to the Secretary of War, urging his confirmation as Major-General in

the U. S. Volunteers, together with others. Two projects for crossing the Rapidan were submitted by this Chief of Staff. Their advantages and disadvantages were discussed, and finally the movement by our left flank decided upon.

The article as published in the December number, 1896, represents the Lieutenant-General as well pleased with the successful crossing of the Rapidan by the Army of the Potomac; and well he might be, for it had been accomplished in the face of an active, well-appointed and ably commanded army. In one day five bridges had been built, over which the army with its artillery and fighting trains had crossed, and a distance of twenty miles marched, without a single mishap, interruption or delay. This result proceeded from a careful and well-digested plan of the Chief of Staff of the Army of the Potomac, which for the information of the general reader is subjoined.

HEADQUARTERS, ARMY OF THE POTOMAC.
May 2, 1864.

ORDERS.

1. The army will move on Wednesday, the 4th of May, 1864.

2. On the day previous, Tuesday, the 3d May, Major-General Sheridan, commanding Cavalry Corps, will move Gregg's cavalry division to the vicinity of Richardville. It will be accompanied by one-half of the canvas ponton train, the engineer troops with which will repair the road to Ely's ford as far as practicable without exposing their work to the observation of the enemy.

Guards will be placed in all the occupied houses on, or in the vicinity of the route of the cavalry, and in advance toward the Rapidan, so as to prevent any communication with the enemy by the inhabitants. The same precaution will be taken at the same time in front of the First and Third Cavalry Divisions, and wherever it may be considered necessary.

At 2 o'clock A. M., on the 4th May, Gregg's division will move to Ely's ford, cross the Rapidan as soon as the canvas ponton bridge is laid, if the river is not fordable, and as soon as the infantry of the Second Corps is up will move to the vicinity of Piney Branch Church, or in that section, throwing reconnoissances well out on the Pamunkey road toward Spottsylvania Court House, Hamilton's crossing, and Fredericksburg.

The roads past Piney Branch Church, Tod's tavern, etc., will be kept clear for the passage of the infantry the following day.

The cavalry division will remain in this position to cover the passage of the army trains, and will move with them and cover their left flank.

At midnight on the 3d May the Third Cavalry Division, with one-half the canvas ponton bridge train, which will join it after dark, will move to Germanna ford, taking the plank-road and cross the Rapidan as soon as the bridge is laid, if the river is not fordable, and hold the crossing until the infantry of the Fifth Corps is up; it will then move to Parker's store on the Orange Court House plank-road or that vicinity, sending out strong reconnoissances on the Orange plank and pike roads, and the Catharpin and Pamunkey roads, until they feel the enemy, and at least as far as Robertson's tavern, the Hope Church, and Ormond's or Robinson's. All intelligence concerning the enemy will be communicated with promptitude to headquarters, and to the corps and division commanders of the nearest infantry troops.

Major-General Warren, commanding Fifth Corps, will send two divisions at midnight of the 3d instant by way of Stevensburg and the plank-road to the crossing of Germanna ford. So much bridge train as may be necessary to bridge the Rapidan at Germanna ford, with such artillery as may be required, will accompany these divisions, which will be followed by the remainder of the corps at such hour that the column will cross the Rapidan without delay. Such disposition of the troops and artillery as may be found necessary to cover the bridge will be made by the corps commander, who, after crossing, will move to the vicinity of the Old Wilderness tavern on the Orange Court House pike. The corps will move the following day past the head of Catharpin Run, crossing the Orange Court House plank-road at Parker's store.

4. Major-General Sedgwick, commanding Sixth Corps, will move at 4 A. M., on the 4th inst. by way of Stevensburg and the Germanna plank-road to Germanna ford, following the Fifth Corps, and after crossing the Rapidan will bivouac on the heights beyond. The canvas ponton train will be taken up as

soon as the troops of the Sixth Corps have crossed, and will follow immediately in rear of the troops of that corps.

So much of the bridge train of the Sixth Corps as may be necessary to bridge the Rapidan at Culpeper Mine ford will proceed to Richardsville in rear of the reserve artillery, and as soon as it is ascertained that the reserve artillery are crossing, it will move to Culpeper Mine ford, where the bridge will be established.

The engineers of this bridge train will at once open a road from Culpeper Mine ford direct to Richardsville.

5. Major-General Hancock, commanding Second Corps, will send two divisions, with so much of the bridge train as may be necessary to bridge the Rapidan at Ely's ford, and such artillery as may be required, at midnight of the 3d inst., to Ely's ford. The remainder of the corps will follow at such hour that the column will cross the Rapidan without delay.

The canvas ponton train at this ford will be taken up as soon as the troops of this corps have passed, and will move with it at the head of the trains that accompany the troops. The wooden ponton bridge will remain.

The Second Corps will enter the Stevensburg and Richardsville road at Madden's, in order that the route from Stevensburg to the plank-road may be free for the Fifth and Sixth Corps. After crossing the Rapidan the Second Corps will move to the vicinity of Chandler's or Chancellorville.

6. It is expected that the advance divisions of the Fifth and Second Corps, with the wooden ponton trains, will be at the designated points of crossing not later than 6 A. M. of the 4th inst.

7. The reserve artillery will move at 3 A. M. of the 4th inst. and follow the Second Corps, passing Mountain Run at Ross's mills or Hamilton's crossing at Ely's ford, take the road to Chancellorville, and halt for the night at Hunting Creek.

8. Great care will be taken by the corps commanders that the roads are promptly repaired by the pioneers wherever needed, not only for the temporary wants of the division or corps to which the pioneers belong, but for the passage of the troops and trains that follow on the same route.

9. During the movement on the 4th and following days, the

commanders of the Fifth and Sixth Corps will occupy the roads on the right flank to cover the passage of their corps, and will keep their flanks well out in that direction.

The commanders of the Second Corps and reserve artillery will in a similar manner look out for the left flank.

Wherever practicable, double columns will be used to shorten the columns. Corps commanders will keep in communication and connection with each other, and coöperate whereever necessary. Their picket lines will be connected. They will keep the Commanding General constantly advised of their progress and of everything important that occurs, and will send staff officers to acquaint him with the location of their headquarters. During the movement of the 4th instant headquarters will be on the route of the Fifth and Sixth Corps. It will be established at night between those corps and the Germanna plank-road.

10. The infantry troops will take with them fifty pounds of ammunition upon the person, three (3) days' full rations in the haversacks, three (3) days' bread and small rations in the knapsacks, and three days' beef on the hoof.

Each corps will take with it one half of its intrenching tools, one hospital wagon, and one medium wagon for each brigade; one-half of the ambulance trains and the light spring-wagons, and pack animals allowed at the various headquarters.

No other trains or means of transportation than those just specified will accompany the corps, except such wagons as may be necessary for the forage for immediate use for five (5) days. The artillery will have with them the ammunition of the caissons only.

11. The subsistence and other trains loaded with the amount of rations, forage, infantry and artillery ammunition, etc., heretofore ordered, the surplus wooden pontons of the different corps, etc., will be assembled under the direction of the Chief Quartermaster of the army in the vicinity of Richardsville, with a view to crossing the Rapidan by bridges at Ely's ford and Culpeper Mine ford.

12. A detail of 1000 or 1200 men will be made from each corps as guard for its subsistence and other trains; this detail will be composed of entire regiments as far as practicable.

No other guards whatever for regimental, brigade, division, or corps wagons will be allowed. Each detail will be under the command of an officer selected for that purpose, and the whole will be commanded by the senior officer of the three.

This guard will be so disposed as to protect the trains on the march and in park. The trains are likewise protected by cavalry on the flank and rear.

13. Major-General Sheridan, commanding the Cavalry Corps, will direct the First Cavalry Division to call in its pickets and patrols on the right on the morning of the 4th instant and hold itself ready to move and cover the trains of the army; it will picket and watch the fords of the Rapidan from Rapidan station to Germanna ford. On the morning of the 5th the First Cavalry Division will cross the Rapidan at Germanna ford and cover the right flank of the trains while crossing the Rapidan and during their movement in rear of the army.

The signal stations on Cedar, Poney, and Stoney Mountains will be maintained as long as practicable.

14. The wooden ponton train at Germanna and Ely's fords will remain for the passage of General Burnside's army. That at Culpeper Mine ford will be taken up under the direction of the Chief Engineer as soon as the trains have crossed, and will move with the train of its corps.

By command of Major-General Meade,

(Signed) S. WILLIAMS,
Asst. Adjutant General.

The order issued May 4th for a continuance of the movement on May 5th conformed to that of May 2d, but owing to indications of the enemy's movements on the 4th the order of march was partial in character and it contemplated the probability of an engagement that day.

HEADQUARTERS, ARMY OF THE POTOMAC,
May 4, 1864, 6 P. M.

ORDERS.

The following movements are ordered for the 5th May, 1864:

1. Major-General Sheridan, commanding Cavalry Corps, will move with Gregg's and Torbert's divisions against the

enemy's cavalry in the direction of Hamilton's crossing. General Wilson, with the Third Cavalry Division, will move at 5 A. M. to Craig's Meeting House, on the Catharpin road. He will keep out parties on the Orange Court House pike and plank road, the Catharpin road, Pamunkey road (road to Orange Spring), and in the direction of Twyman's store and Andrew's tavern, or Good Hope Church.

2. Major-General Hancock, commanding Second Corps, will move at 5 A. M. to Shady Grove Church, and extend his right towards the Fifth Corps at Parker's store.

3. Major-General Warren, commanding Fifth Corps, will move at 5 A. M. to Parker's store, on the Orange Court House plank-road, and extend his right towards the Sixth Corps, at the Old Wilderness tavern.

4. Major-General Sedgwick, commanding Sixth Corps, will move to Old Wilderness tavern on the Orange Court House pike as soon as the road is clear. He will leave a division to cover the bridge at Germanna ford until informed from these headquarters of the arrival of General Burnside's troops there.

5. The Reserve Artillery will move to Corbin's bridge as soon as the road is clear.

6. The trains will be parked in the vicinity of Todd's tavern.

7. Headquarters will be on the Orange Court House plank-road, near the Fifth Corps.

8. After reaching the points designated, the army will be held ready to move forward.

9. The commanders of the Fifth and Sixth Corps will keep out detachments on the roads on their right flank. The commander of the Second Corps will do the same on the roads in his front.

Their flankers and pickets will be thrown well out, and their troops be held ready to meet the enemy at any moment.

By command of Major-General Meade.

(Signed) S. WILLIAMS,
Asst. Adjutant General.

The writer "of the events of May 6th, 1864," states instructions were sent, to have all the ponton bridges over the Rapidan taken up, except the one at Germanna ford. What other bridges are meant? Five were thrown over that river May the

4th, 1864, four were taken up May the 5th, 1864, leaving one at the Germanna ford, and that one was removed and relaid at Ely's ford May the 7th, 1864, for the passage of the ambulance trains containing the wounded, whose destination however was subsequently changed to Fredericksburg, Virginia. On reading of the "confusion caused by a night attack" upon the Sixth Corps on the evening of May 6th, 1864, at the Wilderness, Virginia, one is forced to the conclusion, from a remark (see page 345 *Century*, January, 1897), the army was put to its trumps by that assault, which required the personal intervention of the Lieutenant General to restore the lines of battle. Of this the Chief of Staff remarks: "Soon after this flank attack began, Staff officers of the Sixth Corps rode into General Meade's Headquarters and informed me (General Meade was at General Grant's Headquarters near by) that in endeavoring to carry dispatches to right of their lines, they found that it had just been broken and rolled up; that the enemy occupied the position; and that a part of them were advancing down Germanna plank-road on our right and rear, following the fugitives from Shaler's and Seymour's brigades; and they added, that probably, both Sedgwick and Wright were captured. I at once made disposition to meet this, with the provost guard, and some troops that General Warren sent me, and the reserve artillery near by; and then sent notice of the affair to General Meade, who at once came over with General Grant. Soon the staff officers, whom I had sent up the Germanna road, to rally the fugitives, returned, reporting there was no enemy on it. Reports from a brigade of Warren's Corps sent in the same direction, confirmed their report; and then information was received from General Sedgwick and General Wright, showing the actual condition of the corps. I have mentioned these details, because *exaggerated statements* [italics are mine] concerning this affair, which quickly spread throughout the army, gave rise I think to unfounded rumors."

The open ground, from which Gordon had delivered his attack upon the right flank of the Sixth Corps, had been noted that day by General Wright, and the want of troops alone had prevented him from visiting the Confederates in the same manner as they did us. It is true Lee directed Anderson to move

at 3 A. M. May the 8th, 1864, but the latter, for reasons best known to himself, (which however are not given) marched at 11 P. M. of that night. The diary of this corps makes no mention of the cause for this early movement, simply stating, "at 11 P. M. we take up the line of march for Spottsylvania Court House." "In a shady grove where we rested an hour at dawn of the 8th." General W. N. Pendleton, Chief of Artillery for the Army of Northern Virginia, states in his official report, "General Anderson stated, that his orders were to move at 3 next morning. He was preparing to start at 11 that night. These four hours anticipated, were of incalculable value next day." Why these hours were so valuable to the Confederates the writer will endeavor to relate. From the memoirs of General Sheridan, Vol I., page 363, we gather, the trains of the Army of the Potomac were put in motion, to go into park at Piney Branch Church, in anticipation of the movement that night, May the 7th, 1864, of that army for the possession of Spottsylvania Court House. The ground upon which the trains were to park, was then held by the Confederate cavalry. To gain this ground brought on the cavalry engagement of Todd's tavern; which ended in driving from there and pursuing the Confederates almost to Spottsylvania Court House; but deeming it prudent to recall the pursuers, about dark Gregg's and Merritt's divisions were encamped in the open fields to the east of Todd's tavern, in view of General Grant's orders for a movement of the Army of the Potomac that night, whereby we hoped to gain Spottsylvania Court House early the next day, May the 8th, 1864. General Sheridan gave orders to Gregg and Merritt, to move at daylight, May the 8th, for the purpose of obtaining possession of Snell's bridge over the Po (south of Spottsylvania Court House), Gregg by crossing at Corbin's bridge (west of Spottsylvania Court House) and Merritt by the Block House. Wilson, then at "Alsop's," was to gain possession of Spottsylvania Court House at an early hour of the 8th of May, and from there move into position at Snell's bridge, conjointly with the others. Wilson moved as ordered, gained Spottsylvania Court House, but was subsequently driven out early that morning by some of Anderson's corps. Generals Grant and Meade arrived at Todd's tavern about midnight of May the 7th; the latter gen-

eral found there Gregg's command and Merritt's somewhat further forward, on the road to Spottsylvania Court House. As yet these officers had not received their orders. At 1 A. M., May the 8th, 1864, General Meade directed Merritt to move his command at once beyond Spottsylvania Court House, placing one brigade at the Block House (intersection of the Shady Grove Church road with the Old Court House road, a mile and one-half west of the court house, and a mile east of the Shady Grove road bridge over the Po), Merritt to picket the roads approaching the Court House from the north and west, the other two brigades of his division to cover our trains. Merritt in addition to open the Brock road, beyond the Court House (south) for the Infantry Corps, who were to closely follow him and occupy that place. Gregg to move immediately to the vicinity of Corbin's bridge, watch the roads leading in there from Parker's Store (the Army of Northern Virginia being in that vicinity); and after the Second Corps had reached Todd's tavern, to send back on the Brock road a force to watch it in the direction of the Wilderness. At the same hour General Sheridan was notified of these instructions sent to his Division Commanders. In his memoirs General Sheridan writes, on the morning of the 8th of May, 1864, he found such orders (those of General Meade) had been given to his cavalry, that he strongly objected to them, but at that time it was too late to carry out the combination he had projected the night before; that he then joined Merritt on the Spottsylvania road and found General Warren complaining that the cavalry were obstructing his infantry column. General Merritt was withdrawn. General Gregg received the following orders dated May the 8th, 1864, 1 A. M., and it is assumed that they were also for General Sheridan. The hour of their receipt by General Gregg is not known; these instructions read "Move with your command at 5 A. M. on the Catharpin road, crossing at Corbin's bridge, and take position at Shady Grove Church. General Merritt will follow you, and at Shady Grove Church will take the left hand or Block House road, moving forward and taking up position at that point (namely, Block house). Immediately after he has passed, you will move forward with your division on the same road, to the crossing of the Po river where you will take up position, sup-

porting General Merritt. General Wilson with his division will march from Alsop's by way of Spottsylvania Court House and the Gate to Snell's bridge, where he will take up position. The infantry march to Spottsylvania to-night." By this order Merritt takes position at the Block House and Gregg at Corbin's bridge supporting him. Both commands face east. The cavalry were to move at daylight of the 8th. The leading Infantry Corps of the Army of the Potomac (5th) was expected to be in position at Spottsylvania Court House by daylight of the 8th, and would have been, but for the resistance of Fitzhugh Lee on the Brock road. Had Generals Merritt and Gregg moved at any time on the night of May the 7th, or the morning of May the 8th, they would have been opposed by Hampton's Cavalry Division (in the same manner in which Merritt was opposed by Fitzhugh Lee on the Brock road); for the latter general had fallen back on that road (the Shady Grove Church road) after the engagement at Todd's tavern and he held it. Besides by 1 A. M. of May the 8th, Longstreet's, now Anderson's, Corps had occupied the roads by which Gregg and Merritt were ordered to move to the Block House and Shady Grove road bridge over the Po. Had Gregg and Merritt gotten rid of Hampton, and attempted to carry out their orders, they would have found between them, and the points they were to occupy, Anderson's Corps. General Meade would never have presumed to alter, amend, rescind, or substitute, his orders for those of the Lieutenant General; and had he been informed of their issue, or had orders from higher authority been produced by the several Cavalry Division Commanders, the Commander of the Army of the Potomac would have gracefully bowed to superior authority. General Meade signed these orders himself and General Sheridan was notified of their issue at the same time. (See Badeau's statement as authority for Gregg's orders.)

As written in the February number of the *Century* this year, 1897, narrating the movement of Hancock's Corps to Milford's Station and other forward points, and its failure to attract the attention of the Army of Northern Virginia, this magazine says: "The only problem was how to get at him (Lee)." Had the Second Corps marched on the telegraph road, followed by the Fifth Corps; the Sixth and Ninth Corps held subject to ex-

pected developments to be brought about, the proximity of these two corps to the Confederate army might have solved the problem. This telegraph road was one of the lines of communication for the Confederate army where it leaves Spottsylvania Court House on the south, and is about ten miles nearer to that place than the route to Milford's Station.

This road is one of the shortest lines from Spottsylvania Court House to Hanover Junction, an important point of great value to the Confederate army. Such a challenge referring to the project of a movement of the Second and Fifth corps upon this road (the telegraph), might probably have been accepted by the Confederates and a battle without intrenchments fought. The *Century Magazine* avers there were but "two men who could remain absolutely immovable under a heavy fire." The writer was a member of the Army of the Potomac when upon the Peninsula, March, 1862, and up to and including Appomattox Court House, Virginia, April 9, 1865, and has knowledge of more gentlemen "*who could remain absolutely immovable under heavy fire.*" His experience was varied, his acquaintance extensive, embracing many officers of high rank, who commanded troops in that glorious Army of the Potomac. The position of the writer during this period was first, that of a staff officer to the Chief of the Topographical Engineers of General G. B. McClellan's army, then operating in the Peninsula; as an Aid to a General of Division, who, after Gettysburg, Pa., became the Chief of Staff to the Commander of the Army of the Potomac; and who subsequently commanded the Second Corps, upon the assignment of General Hancock to other duties. The writer modestly affirms his judgment and knowledge of this matter.

As to General Lee's lines "stretched out almost to the breaking point," it is observed when General Hunter was marching upon Charlottesville, Virginia, General Early's corps was detached from the Army of Northern Virginia, June the 11th, 1864, and marched to the Valley of Virginia on the morning of June 13th, 1864. Furthermore, General Lee, on learning of the disaster which had overtaken his troops in that section, sent at once to that point General Breckinridge with the force he had brought with him to the Army of Northern Virginia, and General

porting General Merritt. General Wilson with his division will march from Alsop's by way of Spottsylvania Court House and the Gate to Snell's bridge, where he will take up position. The infantry march to Spottsylvania to-night." By this order Merritt takes position at the Block House and Gregg at Corbin's bridge supporting him. Both commands face east. The cavalry were to move at daylight of the 8th. The leading Infantry Corps of the Army of the Potomac (5th) was expected to be in position at Spottsylvania Court House by daylight of the 8th, and would have been, but for the resistance of Fitzhugh Lee on the Brock road. Had Generals Merritt and Gregg moved at any time on the night of May the 7th, or the morning of May the 8th, they would have been opposed by Hampton's Cavalry Division (in the same manner in which Merritt was opposed by Fitzhugh Lee on the Brock road); for the latter general had fallen back on that road (the Shady Grove Church road) after the engagement at Todd's tavern and he held it. Besides by 1 A. M. of May the 8th, Longstreet's, now Anderson's, Corps had occupied the roads by which Gregg and Merritt were ordered to move to the Block House and Shady Grove road bridge over the Po. Had Gregg and Merritt gotten rid of Hampton, and attempted to carry out their orders, they would have found between them, and the points they were to occupy, Anderson's Corps. General Meade would never have presumed to alter, amend, rescind, or substitute, his orders for those of the Lieutenant General; and had he been informed of their issue, or had orders from higher authority been produced by the several Cavalry Division Commanders, the Commander of the Army of the Potomac would have gracefully bowed to superior authority. General Meade signed these orders himself and General Sheridan was notified of their issue at the same time. (See Badeau's statement as authority for Gregg's orders.)

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Breckinridge's leaving was anterior to the departure of General Early. We were unable to carry Lee's lines at Cold Harbor.

General Early's corps, afterward commanded by General Gordon, rejoined its army some time in November or December, 1864.

PASSAGE OF THE JAMES RIVER.

As to the crossing of this river by the Army of the Potomac, General Porter states he accompanied Colonel Comstock, who visited General Butler, then at Bermuda Hundred, conferring with him, and on returning, finally selected a point suitable for the laying of a ponton bridge; that point being Fort Powhattan, on the north bank of this river, Windmill Point, on the south bank, the other; that their return to the Army of the Potomac was on the afternoon of June the 12th, 1864. The personal memoirs of General Grant, on page 284, Vol. II., mentions on June the 8th, 1864, he had directed General Meade "to fortify a line down the bank overlooking the Chickahominy, under cover of which the army could move"; again, on page 286 of the same volume, in the instructions given General Meade under date of June the 11th, 1864, it is stated by the Lieutenant-General, "*the movement will be made as heretofore agreed upon.*" From this it would appear a point for passing over the James River had been "agreed upon" previously to the departure of Colonel Comstock, who evidently carried instructions to General Butler; and in addition was instructed to see if some other point on the James River than that "agreed upon," was more suitable.

Some knowledge of the James River had been acquired when the Army of the Potomac was on the Peninsula in 1862; and this information no doubt jotted down for future reference by the Engineer officers attached to that army. Furthermore, "the movement" "as heretofore agreed upon" must have been discussed, information of the country not revealed by maps looked up; maps consulted, and finally a project drawn out for the march to the James; which project would have probably contained provisions for other points selected for the crossing of this river had Colonel Comstock returned sooner than he did. Such a project would not have been materially modified had other points been selected, for had such been the case the point decided upon might have been further up the James River, possi-

bly nearer City Point. The project or order of march upon which the army moved is as follows:

HEADQUARTERS, ARMY OF THE POTOMAC,
June 11, 1864.

ORDERS.

The following movements are ordered:

1. At dark on the evening of the 13th instant Brigadier-General Wilson will move the brigade of cavalry picketing the Chickahominy across the swamp at Long bridge or that vicinity, and out on the Long bridge road toward the crossing of White Swamp, and toward the Charles City, Central and New Market roads.

The brigade will move promptly and clear the road for the Fifth Corps.

The pickets at the crossings of the Chickahominy will remain until relieved by infantry pickets.

2. During Saturday, the 11th instant, Major-General Warren will move the two divisions of his corps now held in reserve to Moody's by way of Parsley's Mill and Prospect Church, etc., so as to avoid the observation of the enemy. At dark on the evening of the 12th instant he will move his whole corps to Long bridge, by the shortest route, across the Chickahominy, and move on the road to White Oak Swamp bridge (called Long bridge road) and hold that road, looking toward the crossing of White Oak Swamp and Charles City, Central, and New Market roads, during the passage of the army toward James River. He will follow the Second Corps toward Charles City Court House.

General Warren will picket the crossings of the Chickahominy on his flank while moving to Long bridge, relieving the cavalry pickets.

3. Major-General W. F. Smith, Eighteenth Corps, will withdraw as soon after dark as practicable on the evening of the 12th instant, and move by way of Parsley's mill, Prospect Church, Hopeville Church, Tunstall's Station to White House, where he will embark and proceed to Bermuda Hundred. Upon reaching Tunstall's Station his artillery and trains will join the main trains of the army.

4. Major-General Burnside, Ninth Corps, will withdraw as soon after dark as practicable on the evening of the 12th in-

stant, and move by way of Allen's mill (or by roads avoiding Smith's route), then north of the south fork of the Matadequin to Burtin's, thence past Hughes's, Watt's, Clapton's, Turner's store, etc., to Tunstall's Station, or by any adjoining route, avoiding Smith's, that may be found to Tunstall's Station.

At Tunstall's Station the corps of General Smith has precedence. When it has cleared the way, General Burnside will move to Jones's bridge, taking care not to interfere with routes of other corps, past Baltimore Cross Roads and Emman's Church.

Where the routes of the Sixth and Ninth Corps unite, about three miles from Jones's bridge, the corps that reaches the point first will have precedence.

After crossing at Jones's bridge Major-General Burnside will take the route passing east of Charles City Court House, by Vandorn's, Clapton, and Tyler's mill.

5. Major-General Wright, Sixth Corps, will withdraw as soon after dark as practicable on the evening of the 12th instant to the intrenched line in his rear, from Allen's pond to Elder's swamp, and in conjunction with the Second Corps hold that line until the roads for the Second and Sixth Corps are well cleared by the Fifth Corps, when the two corps will withdraw.

General Wright will move by way of Cool Arbor, Taylor's, J. P. Parsley's, Widow Vias, Good's, and Hopkin's mill to Moody's, and thence by way of Emman's Church to Jones's bridge, preceding or following the Ninth Corps, as already indicated, when the routes unite.

After crossing the Chickahominy General Wright will take the route to Charles City Court House by Vandorn's.

6. Major-General Hancock, Second Corps, will withdraw as soon after dark as practicable on the evening of the 12th instant, to the intrenched line in his rear, from Allen's pond to Elder's swamp, and hold that line in conjunction with the Sixth Corps until the roads for the Second and Sixth Corps are well cleared, when he will move by routes in his rear to the Despatch Station road, avoiding the roads of the Sixth Corps, and by Despatch Station and the shortest route to Long bridge. He will look out for the crossings of the Chickahominy on his flanks while passing.

After crossing the Chickahominy General Hancock will move toward Charles City Court House by way of St. Mary's Church, Walker's, etc.

7. Brigadier-General Ferrero will move his division at dark on the evening of the 12th instant, to the trains of the army near White House or Cumberland, and cover them during the movement.

8. The trains will move to the Window Shades and cross the Chickahominy in that vicinity. They will take such routes as will not interfere with the movements of the troops.

9. The brigade of cavalry on the right will withdraw at the same time as the Sixth and Second Corps, and close in on the rear of the army and cover it and the trains during the movement.

10. Corps commanders will see that every precaution is taken to secure the rapid execution of this movement, and that the troops move promptly and quickly on the march.

11. Headquarters during the movement will be at Pollard's or Cedar Grove, near Long bridge, and until established there will be on the route of the Sixth Corps as far as Emman's Church.

12. Eight canvas and eight wooden pontons will accompany the Fifth Corps to Long bridge.

The engineers will establish bridges at Jones's bridge with the remaining eight canvas pontons and the wooden pontons of the Sixth Corps.

The wooden pontons of the Second Corps will accompany the main train of the army.

13. The pickets of the several corps will be withdrawn at the same hour from the line of intrenchments before daylight of the 13th instant, and will follow the routes of their respective corps.

14. The corps will take with them on the march merely those light headquarters wagons, ammunition wagons, ambulances, etc., specified for the march across the Rapidan. All others will be sent at once to the main trains of the army.

15. The depot at White House will be continued for the present with its permanent garrison, but all supplies, etc., for this army will be moved to the James River, leaving 50,000

rations subsistence and 30,000 rations of forage, in addition to supplies for the garrison. On the arrival of the Major-Generals Sheridan and Hunter the post at White House will be broken up and transferred to Yorktown, from which place the commanding officer will report his arrival to these headquarters.

By command of Major-General Meade.

S. WILLIAMS,
Asst. Adjutant General.

The argument of the writer, that all special projects for the movements of an army, fall as a matter of duty upon the chief of staff of an army, is confirmed by the Lieutenant General, who is quoted on page 486 of the *Century* number for the month of February, 1897, as follows:

"I am fully aware that some embarrassments arise from the present organization, but there is more weight on the other side of the question. I am commanding all the armies, and I cannot neglect others by giving my time exclusively to the Army of the Potomac, which would involve performing all the detailed duties of an army commander, directing its administration, enforcing discipline, reviewing its court-martial proceedings, etc. I have Burnside's, Butler's, and Sigel's armies to look after in Virginia, to say nothing of our Western armies, and I may make Sheridan's cavalry a separate command. Besides, Meade has served a long time with the Army of the Potomac, knows its subordinate officers thoroughly, and led it to a memorable victory at Gettysburg. I have just come from the West, and if I removed a deserving Eastern man from the position of army commander, my motives might be misunderstood, and the effect be bad upon the spirits of the troops. General Meade and I are in close contact on the field; he is capable and perfectly subordinate, and by attending to the *details* [the italics are mine] he relieves me of much necessary work, and gives me more time to think and to mature *my general plans* [the italics are mine]. I will always see that he gets full credit for what he does."

The writer agrees with General Porter, "*This memorable operation (passage of the James River) when examined in all its details, will furnish one of the most valuable instructions and studies in logistics*," and the writer adds also tactics.

A good map on a large scale will aid the general reader in understanding this movement, for on one smaller many places cannot be given which a larger one will do. Lee's army at Cold Harbor, was distant from Butler at Bermuda Hundred, by way of Drury's Bluff, about 24 miles, and about 34 miles from Petersburg. The march of the Army of the Potomac to this latter place was about 50 miles. Some description of the country, confined to streams and roads must be given, at the risk of becoming prolix, else the reader will not understand what was attempted and what was the result of the attempt. To reach the James River the Chickahominy must be crossed; and the points of crossing that stream should be some distance below Cold Harbor; and so far below, that a sufficient force could be thrown over it and in position to cover the crossing of the remainder of the army, before Lee could learn the movement had taken place. This stream was crossed by bridges below Lee's force at Cold Harbor at the following places, viz.: Bottom's bridge 8 miles, Long bridge 15 miles, Jones's bridge 20 miles, Window or Windsor Shades bridge 23 miles; all these bridges had been destroyed.

Two miles below Bottom's bridge, the White Oak Swamp enters into the Chickahominy. It heads about one mile north west from Seven Pines. Its general course is east and length 10 miles. Character swampy, filled with trees and a dense undergrowth. Its crossing difficult. Three miles above its mouth it is crossed by a bridge, and a road running south from near Bottom's bridge; which road, about a mile south of the bridge, is crossed by the Long bridge road. No other main roads cross it but some plantation roads do. Between this swamp and the James River three roads lead to Richmond, viz.: Charles City road, Central road, New Market or River road. General direction of the Long bridge road after crossing the Chickahominy is south-westerly. Five miles from Long's bridge, it is entered by a road from White Oak bridge; a mile further on, it is entered by the Charles City road, and by the Quaker road from the south, crossing from the River road at Malvern Hill. *At this point of meeting of the three roads is Riddle's shop.*

The Fifth and Second Corps crossed at Long's bridge, the Sixth and Ninth Corps at Jones's bridge. The great trains from

the White House at Windsor Shades and Cole's ferry. Of Wilson's division of cavalry, one brigade was on the right of the army, the other on the left which picketed the Chickahominy. On June 10, 1864, the Fifth Corps was directed to move two of its divisions, held in reserve near Leary's on the 11th, to *Moody's* four miles from Bottom's bridge, and keep them out of observation of the enemy. The commander of this corps was advised confidentially of the part his corps would play in the march to the James, and to be prepared to move as soon as it was dark on the evening of June 12, 1864. The brigade of cavalry on the left preceded the Fifth Corps upon its movement, which began at the hour directed in the order. The brigade of cavalry on the right withdrew at the same time the Sixth and Second did, covering the rear of the army and the trains during the movement. At the time designated in the order the Second and Sixth Corps withdrew, and occupied the intrenched line in rear of Elder Swamp to Allen's mill-pond, until the roads were clear for this movement when they marched. The Eighteenth Corps having precedence over all, moved to the White House on the Pamunkey and embarked for Bermuda Hundred, arriving there during the night of June 14, 1864.

Of this movement of the army, which for sake of brevity has been condensed, the Chief of Staff of the Army of the Potomac on page 201 of "The Virginia Campaign of 1864 and 1865," remarks "In preparing the programme of movement it appeared *to me* important, that General Warren, commanding the Fifth Corps, should move out the Long bridge road, not only far enough to cover the crossing of the Chickahominy by the army, but so far as to hold the bridge over the White Oak Swamp, and to look toward the three roads to Richmond already mentioned (Charles City, Central road and New Market), which substantially met at *Riddle's shop* about a mile in advance of the position General Warren was directed to take. He could not well advance to Riddle's shop, since that would have exposed him to an attack in rear, from the White Oak Bridge. It was expected that such a movement by General Warren would deceive Lee, and give him the impression that the Army of the Potomac was advancing upon Richmond; or if intending to cross the James, that it would do so at Malvern Hill, City Point or above. The movement made

the desired impression upon him and to a greater extent than was contemplated, for we shall see further on, *he was uncertain what the Army of the Potomac was doing, until the afternoon of the 17th of June, 1864.*" A ponton bridge was laid at Long bridge at 1 A. M. of June 13, 1864, the cavalry crossed at once, followed by two divisions of the Fifth Corps, which moved to the position designated for them, backed by the other two divisions of the corps held in reserve. The cavalry pushed forward, parties on the Charles City and Central roads having sharp encounters. The cavalry on moving out met sharp opposition on the White Oak bridge and Riddle's shop road. The Second Corps followed the Fifth Corps and reached the James on the 13th of June, 1864; the Sixth and Ninth Corps arrived at the James on the 14th of of June. The Fifth Corps withdrew to St. Mary's Church on the night of June 13th and arrived at Charles City Court House, at midday, June 14, 1864.

The bridge crossing the James River was commenced at 4 P. M. of June 14th and finished at midnight. At midnight of June 16, 1864, the army, its artillery and trains, were across the river, the Sixth Corps covering the operation. The cavalry held the position toward White Oak Swamp and Malvern Hill and then withdrew. On the morning of the 13th of June, General Lee discovered the Army of the Potomac had withdrawn from Cold Harbor, and learnt it was advancing toward Richmond, on the Long bridge road.

His two corps, Anderson's and Hill's, were put in motion for that road, and finally occupied and held ground running from Malvern Hill, on the James River, to White Oak Swamp, on the left, covering Richmond. On the afternoon of the 14th and morning of the 15th of June, 1864, our cavalry advanced toward Malvern Hill and White Oak Swamp. *This demonstration of the cavalry caused the retention of Anderson and Hill in the position taken up by them on the evening of June 13, 1864.*

By 10 A. M. of June 16th, the Second and Ninth Corps, together with the troops under General Smith, were assembled in the vicinity of Petersburg, Virginia, and by midnight of the 16th of June the Fifth Corps was but a few miles distant. At 2 A. M. of June 16, 1864. Anderson and Hill were still in the position occupied by them on the evening of June 13, 1864, that is Mal-

vern Hill and Riddle's shop. General Lee, at 10:30 A. M., June 16, 1864, telegraphed Beauregard at Petersburg, Virginia, that he did not know the position of Grant's army, and could not strip the north bank. At 3 P. M. he telegraphed he had not heard of Grant's crossing the James River. *At that hour only the Sixth Corps and Wilson's cavalry remained on the north bank.*

On June 16, 1864, there were opposing us, about 14,000 infantry besides artillery. No further reinforcements were received by the Confederates, until the morning of June 18, 1864, and later in the day Hill arrived, when once more the united Confederate army faced us from the earthworks at Petersburg, Virginia.

EXPLOSION OF THE MINE AT PETERSBURG, VIRGINIA.

Respecting the explosion of this mine at Petersburg, July 30, 1864, the reader's attention is directed to the following order which explains what was to be done at the explosion and what was to follow.

HEADQUARTERS, ARMY OF THE POTOMAC,
July 29, 1864.

ORDERS.

The following instructions are issued for the guidance of all concerned :

1. As soon as dark Major-General Burnside, commanding Ninth Corps, will withdraw his two brigades under General White, occupying the intrenchments between the plank and Norfolk roads, and bring them to his front. Care will be taken not to interfere with the troops of the Eighteenth Corps moving into their position in rear of the Ninth Corps.

General Burnside will form his troops for assaulting the enemy's works at daylight of the 30th, prepare his parapets and abattis for the passage of the columns, and have the pioneers equipped for work in opening passages for artillery, destroying enemy's abattis, etc., and the intrenching tools distributed for effecting lodgment, etc.

2. Major-General Warren, commanding Fifth Corps, will reduce the number of his troops holding the intrenchments of his front to the minimum, and concentrate all his available force on his right, and hold them prepared to support the assault of Major-General Burnside. The preparations in respect to pio-

neers, intrenching tools, etc., enjoined upon the Ninth Corps will also be made by the Fifth Corps.

3. As soon as it is dark Major-General Ord, commanding Eighteenth Corps, will relieve his troops in the trenches by General Mott's division of the Second Corps, and form his corps in rear of the Ninth Corps, and be prepared to support the assault of Major-General Burnside.

4. Every preparation will be made for moving forward the field artillery of each corps.

5. At dark Major-General Hancock, commanding Second Corps, will move from Deep Bottom to the rear of the intrenchments now held by the Eighteenth Corps, resume the command of Mott's division, and be prepared at daylight to follow up the assaulting and supporting column, or for such other operations as may be found necessary.

6. Major-General Sheridan, commanding Cavalry Corps, will proceed at dark from the vicinity of Deep Bottom to Lee's mill, and at daylight will move with his whole corps, including Wilson's division, against the enemy's troops defending Petersburg on their right, by the roads leading from the southward and westward.

7. Major Duane, Acting Chief Engineer, will have the ponton trains parked at convenient points in the rear, prepared to move. He will see that supplies of sand-bags, gabions, fascines, etc., are in depot, near the lines, ready for use. He will detail engineer officers for each corps.

8. At half past three in the morning of the 30th, Major-General Burnside will spring his mine, and his assaulting columns will immediately move rapidly upon the breach, seize the crest in the rear, and effect a lodgment there. He will be followed by Major General Ord, who will support him on the right, directing his movement to the crest indicated, and by Major-General Warren, who will support him on the left. Upon the explosion of the mine the artillery of all kinds in battery will open upon those points of the enemy's works whose fire covers the ground over which our columns must move, care being taken to avoid impeding the progress of our troops. Special instructions respecting the directions of the fire will be issued through the Chief of Artillery.

9. Corps commanders will report to the Commanding General when their preparations are complete, and will advise him of every step in the progress of the operation and of everything important that occurs.

10. Promptitude, rapidity of execution, and cordial coöperation are essential to success, and the Commanding General is confident that this indication of his expectations will insure the hearty efforts of the commanders and troops.

11. Headquarters during the operation will be at the headquarters of the Ninth Corps.

By command of Major-General Meade,

S. WILLIAMS,
Assistant Adjutant General.

The assault was a failure; upon the request of the Commander of the Army of the Potomac, a Court of Inquiry was appointed by the President of the United States to examine into and report upon the facts and circumstances of this affair; and also to report their opinion of what officers if any were answerable for the want of success of the assault. Their opinion will be found on page 430 of "The Virginia Campaign of 1864 and 1865."

Respecting this operation, General Grant, when before the Committee on the Conduct of the War gave the following evidence:

"That General Meade made his orders most perfectly; even at the time of giving his testimony, when all the facts were known, he did not think he could improve upon the order, and that if the troops had been properly commanded and led in accordance with that order we would have captured Petersburg; but that opportunity was lost, in consequence of the division commanders not going in with their men, but allowing them to go into the enemy's intrenchments, and spread themselves there without going on further; thus giving the enemy time to recover from his surprise, collect his troops, and organize against them. He said further that General Burnside did not prepare his parapets and abattis as he was ordered to do, that the preparations ordered were essential to success, and could have been made without discovery by the enemy; that had he been a corps commander intrusted with the duty * * * he would have

been upon the ground and seen that the preparations were made as ordered, and that had he been a division commander, he would have gone in with his division; and he added, there were a great many officers there (with the army) who would have done the same thing."

General Porter, remarking upon the characteristics of General Grant, when that general felt confidence in an officer's ability to do what was required of him, quotes General Grant as follows: "I feel every confidence that you will do the best, and will leave you, as far as possible, to act on your own judgment, and not embarrass you with orders and instructions." Further on he quotes the general again as saying: "If they gained victories they would be given sole credit for whatever they accomplished." So far as we have been able to discover, General Meade has fully met the expectations of and possessed the confidence of General Grant; for nowhere do we find in the articles as published in the *Century Magazine* that he ever fell below his equation; and while thus recognizing the great ability of the Commander of the Army of the Potomac, we have not lost sight of the careful thought and perspicacity given to the lucid projects of his eminent Chief of Staff for the movements of this army from the crossing of the Rapidan, May 4, 1864, to the siege of Petersburg, beginning June 18, 1864.

The *Century* for September, 1897, narrating the events happening March 31, 1865, and of the attack delivered that day, by the Confederates upon the 5th Corps, states it was reinforced during that action by the 2d. Had the word assisted, appeared in the text, instead of reinforced, the meaning of that sentence would at once have been made clear, and this correction would not be necessary. *Assistance was given by the 2d Corps and at a time when most needed, and this without the asking or directing of it.* That which is here written of, can be found at length on page 332 of the "Virginia Campaign of 1864 and 1865," and page 784 of the 5th Army Corps. The writer contents himself with stating these facts without quoting in detail his authorities.

On page 747 of the *Century Magazine* for September, 1897, the dispatch quoted of Miles division of the 2d Corps

being with General Sheridan, and Miles given credit for his victory over the enemy at Sutherland station, tends to confuse those not conversant with the events as they occurred. The following will explain that affair. At 9 A. M., April 2, 1865, the commander of the 2d Corps was informed by an aide from General Miles, that he and his division were on their return. At the time this information was received, this division was on the White Oak road, two miles west of the enemy's intrenchments at the Claiborne road junction.

Orders were sent to General Miles, as well as the other division commanders, to pursue the enemy to Sutherland station by the Claiborne road. When the commander of the 2d Corps came up with Miles, he found him in contact with what was left of some of the Confederates (after the battle of Five Forks) under Heth, who was forced to halt and give battle. At about this time (the meeting of General Miles) the commander of the 2d Corps received orders to proceed at one to Petersburg, and obeyed, taking with him to that place the other divisions of the corps; but before leaving, learnt from General Miles that he could defeat the force there in his front.

Meanwhile the writer, who, under instructions, was to remain two hours at the "Rainey House," to bring forward dispatches intended for the 2d Corps commander, having completed his tour of duty at the aforementioned place and receiving nothing, rode forward to join the staff, proceeding on the road followed by the 2d Corps before being ordered to Petersburg, Virginia, and found that General Miles, then at Sutherland station, had attacked twice, and each time had been repulsed. Not finding his corps commander there, he rode towards Petersburg, Virginia, carrying with him the request of General Miles for assistance. This message was personally delivered to General Meade, who directed General Humphreys to take one of his divisions and go to the assistance of Miles. Upon arriving at Sutherland station near sundown, it was ascertained that General Miles, *unaided by any one*, had delivered a third attack which was successful.

We remember with keen relish the events of April 6, 1865, but the narrative as published in the *Century* for September, 1897, eviscerates much which is interesting and

instructive in failing to relate how the information of Lee's retreat, on the night of April 5th and early morning of the 6th, was obtained and communicated to the Army of the Potomac. That army moved from Jettersville, Virginia, on the morning of April 6, 1865, towards Amelia Court House for the purpose of engaging there, if found, the Confederate army; each corps having deploying intervals of one thousand yards. The 2d Corps on the the left, when about four miles out, discovered at about 8.30 A. M., a considerable force of Confederates moving westerly, on the north bank of Flat creek; the head of the column had entered woods. The corps was halted, a brigade sent across that creek to develop the strength of that force, and preparations were made to cross Flat creek. General Meade was at once notified. Artillery opened upon the Confederates, not only to do damage, but to inform our army the enemy had been met. The Signal Corps, about 9 A. M., gave information of a similar character. General Meade at once faced his army to the rear and the pursuit began. A part of the 2d Corps crossed Flat creek by wading in water up to the armpits of the men, other portions crossed upon bridges, which were built in short time, and the enemy come up with near Amelia Sulphur Springs, where was had an engagement. The writer cannot do better in relating the events of this day, so far as concerns the 2d Corps, than by quoting from page 379 of the Virginia Campaign of 1864 and 1865, which reads, "a sharp running fight commenced at once with Gordon's Corps, which was continued over a distance of fourteen miles, during which *several partially intrenched positions were carried.* The country was broken, consisting of woods with dense undergrowth and swamp, alternating with open fields, through and over which the lines of battle, followed closely on the skirmish line, with rapidity and good order that is believed to be unexampled. Artillery moved with our skirmish line."

The Confederates were headed for Rice Station, at which place was Longstreet's command. It had marched on the night of April the 5th and early hours of April 6th, passing around our left and rear and arriving at Rice at an early hour. This day our cavalry endeavored to cut in on the Confederate trains, but nearly each time were repulsed by other parts of the

enemy's forces. At Holt's house, near Sailor's creek, the road forks; the left hand leading to Rice's station, the right hand to Perkinson's Mills on Sailor's creek. The main trains of Lee's army followed the right hand road, Gordon's corps covering them, affording such protection as lay in his power. The main Confederate forces marched upon the left hand road to Rice's station and almost immediately formed line of battle; for the cavalry and 6th Corps were near at hand; in point of fact a brigade of Seymour's division of the 6th Corps near Holt's house was temporarily mixed with the 2d Corps. The Commander of the 2d Corps upon arrival at Holt's house saw General Ewell's troops forming line of battle on the north side of Sailor's creek; but he was not aware that Anderson's Corps was beyond Ewell "on the crest" and across the road leading to Rice Station. Knowing our cavalry was close upon the enemy on the Rice Station road, and seeing the 6th Corps at hand, the 2d Corps continued the pursuit of Gordon. "The running contest with Gordon's Corps continued three miles further; the road for many miles being strewn with tents, camp equipage, baggage, battery forges, limbers and wagons. Its last attempted stand was near Perkinson's Mills on Sailor's creek, where just before dark, a short, sharp contest gave us thirteen flags, three guns, several hundred prisoners, and a large part of the main trains of Lee's army, which were together in a confused mass at the crossing of the creek. Gordon attempted to form on the high ground on the opposite side of the creek, but fell back quickly from it as our troops crossed. Night put a stop to the pursuit until daylight of the 7th, for the country and roads were unknown to us. The captures of the corps were thirteen flags, four guns and seventeen hundred prisoners. The killed and wounded probably exceeded ours, and their total loss could not have been less than two thousand.

"Our killed and wounded were three hundred and eleven." (See page 381, Virginia Campaign of 1864 and 1865.) A good day's work even if the captures of the 2d Corps did not come up to, or equal those made by the cavalry and 6th Corps. Of this day it can be said with truth, no corps of our army obtained contact sooner, held on better, or drew blood oftener than did the 2d Corps; and this in line of battle for fourteen miles, over

and through obstacles presented by the country, which were brushed aside with ease, so eager were the men to do good work and add new laurels by carrying several partially intrenched positions to the many already gained by this famous corps. This corps materially aided by its near presence in the captures made by the cavalry and 6th Corps on that day at the battle of Sailor's creek, Virginia.

On page 752 of the same magazine it is stated "General Humphreys was on the north side of the river, isolated from the rest of our infantry, confronted by *large portion of Lee's army.*" The *Century Magazine* is largely in error; the 2d Corps was not confronted by a large portion of Lee's army, but the *whole of it.* General Meade was informed of this in a dispatch written by General Humphreys during the day. An attack from the south in conjunction with one from the north of Farmville was suggested by the 2d Corps' commander; but neither General Meade nor he knew then the Appomattax there could not be forded by infantry; nor did either know there were no pontons available for the construction of a bridge across that stream. Had there been such, a bridge could have been constructed and the troops there in vicinity of Farmville, the 6th and 24th Corps, could have crossed.

Farmville would then have been written instead of Appomattox Court House. Neither would General Sheridan have ridden on to, or General Ord's command marched to Appomattox Court House.

The detention of Lee's army at Farmville, April the 7th, 1865, from 1 P. M. until some hour of that night, gave our cavalry *the necessary time* to forge ahead, as also the troops under General Ord, and to place themselves across the line of retreat of General Lee.

One other matter, small in itself, but big with events had it not been accomplished, was the seizing of a wagon bridge across the Appomattox just below High bridge by the 2d Corps early on the morning of April the 7th, 1865. Had the Confederates succeeded in burning this bridge (which they did not), no infantry could have crossed the Appomattox that day; and Lee would probably have effected his escape to the mountains in the vicinity of Lynchburg, Virginia. The 2d Corps had no pon-

tons with them. High bridge could not be used, as it was an open deck bridge, nor was there any lumber for planking or repairing it. The 2d Corps succeeded in saving most of that structure, but four spans were burnt by the Confederates. The 2d Corps by its presence compelled General Lee to remain in his position north of Farmville, Virginia, until some hours after dark of April the 7th, 1865; and by this detention Lee lost time exceedingly valuable to him, which could not be regained by night marching; lost his supplies at Appomattox Station, and gave time to Sheridan and Ord to place themselves across his path at Appomattox Court House on April 9, 1865. Had no infantry crossed the Appomattox River that day, April the 7th, 1865, Lee could have reached New store that night, Appomattox Station, April the 8th, obtained rations there, and moved that night towards Lynchburg. The next day, April 9th, would have brought him to that place. The two infantry corps, 5th and 24th, under Ord, did not reach Appomattox Court House until 10 A. M. of April the 9th, 1865.

To strengthen the above, though it is self-evident, the following is quoted from pages 386 and 387, Great Commanders' Series:

"The once great Army of Northern Virginia, now composed of two small corps of infantry and the cavalry corps, resumed the march towards Lynchburg, Virginia, on the stage road; but after going four miles stopped and was formed into line of battle in a well chosen position, to give the trains time to get through.

"It was attacked by two divisions of Humphreys' 2d Corps, which had been long hanging on its rear, but repulsed them. Mahone handled Miles roughly. Had Lee not stopped to fight, he could have reached Appomattox Station the afternoon of the 8th of April, obtained rations there, and moved that evening to Lynchburg. The delay allowed Sheridan with two divisions of cavalry, followed by Ord's infantry and 5th Corps, marching by Prince Edward's Court House, to reach Appomattox Station on the evening of the 8th of April, where he captured trains with Lee's supplies and obstructed his march. Ord's infantry did not arrive in front of Appomattox Court House until 10 A. M. of the 9th of April, 1865."

As to the dispatches of General Humphreys to General Meade, informing him what had been accomplished on April the 6th, 1865, and the presence of *General Lee's whole army north of Farmville and confronted by the 2d Corps, April the 7th, 1865*, and also a dispatch from the Commander of the Army of the Potomac forwarding them, the following copies of dispatches are inserted for the information of the reader; they can be found in Vol. XLVI. of the Official Records of the Union and Confederate Armies in the War of the Rebellion, pages 596, 600 and 624:

HEADQUARTERS 2D CORPS,
April 6, 1865, 7.30 P. M.

To Brevet Major-General A. S. Webb,
Chief of Staff.

Our last fight just before dark at Sailor's creek, gave us two guns, three flags and a considerable number of prisoners; two hundred wagons, seventy ambulances with mules and horses to about one-half the wagons and ambulances. There are between thirty and fifty wagons in addition abandoned and destroyed along the road, some battery wagons, forges and limbers. I have already reported to you the capture of one gun, two flags and some prisoners, and the fact that the road for over two miles, is strewn with baggage, cooking utensils, some ammunition and materials of all kinds. The wagons are in a great mass across the approach to the bridge and will take some time to clear it.

(Signed) A. A. HUMPHREYS,
Major-General Commanding.

HEADQUARTERS ARMY OF THE POTOMAC,
April 6, 1865, 10 P. M.
Received 3.20 A. M., April 7, 1865.

To Lieutenant General Grant.

The 6th Corps came up with the enemy about 4 P. M., in conjunction with the 2d Corps on the right, and the cavalry on the left attacked and routed the enemy, capturing many prisoners, among them Lieutenant General Ewell and General Custis Lee. I transmit despatches both from General Humphreys and General Wright, which in justice to these distinguished

officers and the gallant corps they command, I beg may be sent to the War Department for immediate publication.

(Signed) G. G. MEADE,
Major-General Commanding.

HEADQUARTERS 2ND ARMY CORPS,
April 7, 1865, 3.20 P. M.

To Brevet Major-General Webb,
Chief of Staff.

We have Heth, Mahone, and I believe the rest of Lee's army here in my front moving towards Lynchburg. They are intrenched in a too strong position for me to attack them in front, and their flanks extend further than mine. They are extending their flank to my right. I have sent for Barlow (see note below) but do not know at what time he will be up. I have just seen a despatch dated 1.20 P. M., saying Farmville is in our possession and that the cavalry were moving through it.

(Signed) A. A. HUMPHREYS,
Major-General Commanding.

NOTE.

Barlow, under orders given him in compliance with information received from higher authority, followed Gordon up the railroad bed to near Farmville, Virginia, and by his dispositions caused the Confederates to burn one hundred and fifty wagons to prevent them falling into our hands.

WAR DEPARTMENT, WASHINGTON, D. C.
April 7, 1865, 10 A. M.

Major-General Dix,
New York.

General Sheridan attacked and routed General Lee's army yesterday, capturing Generals Ewell, Kershaw, Barton, Corse, and many other general officers, several thousand prisoners and a large number of cannon and expects to force Lee to surrender all that is left of his army. Details will be given speedily as possible but the telegraph is working badly.

(Signed) EDWIN M. STANTON,
Secretary of War.

To return to the narrative which states General Humphreys' Corps "*was close up to the enemy's rear guard*," and further-

more General Seth Williams, Adjutant General, was directed to take to the 2d Corps General Grant's first letter to General Lee. (See page 752 *Century Magazine* for September, 1897.)

The writer remembers this dispatch that referred to above was not brought to the 2d Corps until about 8.30 P. M. of April 7, 1865, when it was immediately sent through our lines to General Lee, whose reply was received back about 9.30 P. M., same night. At that time General Lee's army may have been moving, but his rear guard, Fitz Lee's cavalry, did not leave their position until midnight of the 7th of April, 1865. Time is required to move an army in daylight, and almost double the time at night. Those who read this article may possibly think undue stress has been placed on these matters, but the sum of small things, when gathered together, have sensibly more weight than when treated singly; besides, it is best when writing of events of years ago to hew closely to the line. When General Grant's third letter, written April 9, 1865 (see page 879, *Century Magazine* for October, 1897), was delivered to General Lee about 9 A. M. of that day it was immediately answered, and with it the verbal regrets of General Lee at not having met General Grant, who by this time must have passed from the route of march of the 2d and 6th Corps to that of Generals Ord's and Sheridan's. An incident which caused General Lee to write the note above referred to is here not out of place, as it gives us an insight of the motives which controlled the Commander of the Army of Northern Virginia. The note of General Lee's, that of April 9, 1865, referred to before, was duly forwarded to General Grant, and the 2d Corps continued the pursuit. Whilst so engaged General Humphreys received two earnest requests from General Lee (through his staff officer) not to press forward upon him, to halt, that negotiations were in progress looking to a surrender of his army. These requests were made when the 2d Corps was close upon General Longstreet, whose troops were the rear guard of the Confederate army (see note below).

These requests could not be complied with, and General Lee was so informed, and the 2d Corps continued to press forward.

When these requests of General Lee's were received, he was very urgent, so urgent General Humphreys had to send General Lee word twice he must remove from the ground. General Lee

was in plain sight, and not over one hundred yards distant from the head of the 2d Corps. Had General Grant remained upon the route of the 2d and 6th Corps, the surrender of the Confederate army would have taken place before midday of April 9, 1865.

NOTE.

Before daybreak of the morning of April 9, 1865, General Lee sent Colonel Venable of his staff to General Gordon, commanding the advance, to learn what were the chances of a successful attack. General Gordon replied: "My old corps is reduced to a frazzle, and unless I am supported by Longstreet heavily, I do not think we can do anything more."

Colonel Venable returned with this answer of Gordon's, to which General Lee in reply said: "Then there is nothing left me but to go and see General Grant." (See pages 393 and 395, Campaign in Virginia, 1864 and 1865.)

The above is not written in the spirit of criticism, but to show (in part) what had been accomplished by the brains and brawn of that splendid body of men (the Army of the Potomac), who, during four years of bloody warfare, with heavy sacrifices of lives and limbs, fought to maintain the integrity of the Union.

In preparing this paper the following have been consulted: General A. A. Humphreys' war papers, The Virginia Campaign, 1865–65, Personal Memoirs of Generals U. S. Grant and P. H. Sheridan, The Great Commanders Series, Official Records of the War of the Rebellion, the *Century Magazine* from November, 1896, up to and including October, 1897, and notes of my own. I have borrowed right and left. Many of the arguments introduced are not original with the writer.

Fort Niobrara, Neb., December 7, 1897.

SOME TESTS OF THE MAGNETIC QUALITIES OF GUN STEEL.*

By First Lieut. GEORGE O. SQUIER, 3d U. S. Artillery.

IN designing apparatus for some experiments which were to involve the use of the steel of our new heavy guns under the influence of magnetizing electric currents it became desirable, if not necessary, to know something of the qualities of this steel in a magnetic sense, in the actual final condition in which we find it in the finished gun. In obtaining data for the above purpose, the tests were made with considerable care, and some of the results are here recorded that they may be of use in case similar data is desired in the future, which seems not improbable in view of the rapid advance now being made in the utilization of electrical power for controlling heavy cannon. As has long been known the magnetic value of wrought-iron is several times greater than cast-iron, and the magnetic behavior of each of these as well as steel is so dependent upon its chemical constitution, physical properties, and treatment during manufacture, that tests of the magnetic qualities of iron for electrical machinery have risen to the importance of "tensile strengths" and "elastic limits" in civil engineering operations. Only recently Professor Ewing† has made a large number of tests of sample iron rings submitted by different manufacturers in England which will prove of great service to electrical engineers as well as to the manufacturers themselves.

The experiments to be described were carried out in the laboratory of the Johns Hopkins University and were made upon a muzzle-ring from a 3.2 inch breech-loading rifle cut from the gun as the last operation, and therefore furnishing a sample in the physical condition of a finished gun. The

* This essay was forwarded, under existing regulations, to the Military Information Division of the Adjutant General's Office, and is published in the Journal of The Military Service Institution by permission of the Adjutant General. The publication of the essay is not to be understood as a mark of official sanction of the opinions expressed therein, the author being alone responsible for the views set forth in his paper.

† The London *Electrician*, April, 1894.

steel originally came from the Bethlehem Iron Company, of Bethlehem, Pennsylvania, and is a low steel of remarkable physical qualities, forged, oil tempered and annealed. This particular ring came from the Watervliet Arsenal, and was kindly loaned for these tests by Lieutenant C. D. Parkhurst, 4th Artillery. It is regretted that similar samples from the larger guns were not available for experiments, in order that comparative tests might have been made, but since the steel for all our new guns, both for the army and the navy, is practically the same in character with slightly different physical requirements, the curves given below should be approximately correct for any case which may arise involving gun steel, and can be used directly for designing purposes without great error. The tests are given in some detail instead of the curves alone, as originally intended, as it was suggested that the methods employed might be of some interest.

THE METHOD OF EXPERIMENT.

The sample at hand being in the form of a ring, the ballistic method of experiment was employed which was a modification of Rowland's* method. Rings possess the advantage of furnishing closed magnetic circuits without poles and no leakage, while they have the disadvantage of being difficult to wind as compared with bars. The magnetometer method is suitable when the samples are either in the form of wire or bars which can be taken long enough to be practically endless, or turned into ellipsoids,—while the electro-dynamometer method† with alternating currents for studying hysteresis losses can only be used with thin iron plates or thoroughly laminated iron on account of Foucault currents. In the ballistic method a transient induction current is generated in an exploring coil which surrounds the specimen of iron, and the integral of this current is proportional to the "throw" of a ballistic galvanometer needle in circuit with the exploring coil. The galvanometer used was an ordinary D'Arsonval instrument with telescope and scale, and was made ballistic by weighting the mirror with a long wooden

* Philadelphia Magazine 46, 1873.

† Steinmetz. Transactions of the American Institute of Electrical Engineers. Vol. 9, No. 1.

arm supplied with a metal bob at either end. The galvanometer was calibrated by sending successively currents of increasing strengths through the primary circuit of a standardizing coil, and observing whether the throws varied in a corresponding manner. The diagram shows the arrangement of the circuits.

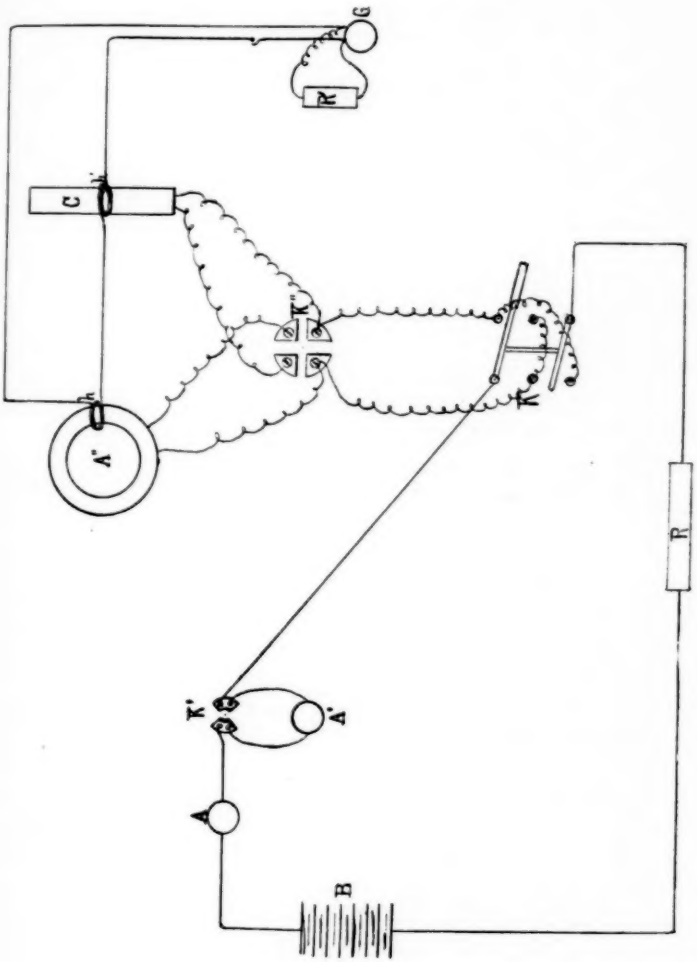


DIAGRAM OF CIRCUITS.

The source of energy E, was a bank of storage cell. K— is a reversing switch — R an adjustable resistance, arranged so that certain definite amounts could be introduced or taken from the magnetizing circuit without break. — A, a standard Weston ammeter.—A' a standard Weston miliammeter in series for the accurate measurement of small values of the magnetizing current,—a cut-out switch K'', allowed the miliammeter to be taken from the circuit without break when the current rose beyond its range. A'' is the specimen ring which was wound with two coils, a primary and a secondary. The ring being first covered with Okonite tape, the secondary coil of fine wire (No. 28) was wound over its entire circumference, and consisted of 200 turns. The secondary was wound inside the magnetizing circuit instead of outside as is usually done to avoid any error due to air space. Over this secondary, a layer of tape was wound, then the primary consisting of 300 turns of No. 16 wire in two layers over the entire ring, with tape between these layers as before.

The switch K'' allowed the magnetizing current to be sent either through the primary circuit of A'', or through the primary of the air-core standardizing induction coil C, which was made to obviate the use of an earth inductor for standardizing the galvanometer and the consequent liability to error due to an inaccurate value of the horizontal component of the earth's field.

The ballistic circuit included the secondary h of the iron ring, the secondary h' of the standardizing induction coil, and the galvanometer G all in series, thus giving a constant resistance in this circuit during a set of observations and simplifying the calculations thereby. The galvanometer was also provided with a shunt R' to regulate its sensitiveness, and the ordinary circuit arrangement for bringing the needle to rest between readings, which is not shown in the diagram.

The use of the standardizing coil made the measurement of the magnetic induction as well as the magnetizing force depend upon the *same* instrument, the Weston standard ammeter, and at the same time permitted, by the large number of turns it contained, inductions being reached sufficient to give ballistic deflections of the same order of magnitude as those given by the ring under test.

CONSTANTS OF THE STANDARDIZING COIL.

This coil was wound upon a wooden rod of sufficient length to insure uniformity at its centre, and large enough to permit its sectional area being accurately determined, while the secondary coil was wound about the middle part of the primary coil.

Number of turns in primary	600 = n.
Mean length	63.5 cm. = *l*.
Mean outer diameter	2.80 cm.
" inner "	2.0 cm.
" diameter	2.4 cm.
" area	4.5239 sq. cm.
Number of turns in secondary	200

To obtain the force we write

$$H = \frac{4\pi}{10} \cdot \frac{nC}{l} = 1.2566 \frac{nC}{l}, \text{ in which } C =$$

strength of current in amperes and H = magnetic force at a point = no. of lines per sq. cm. induced in air.

Substituting the above constants we write

$$H = 11.873\ C \text{ and}$$

Total cutting of magnetic lines = $H \times$ area of coil $\times$ no. turns in secondary = 10,742.4529 C.

CONSTANTS OF THE TEST RING.

Mean external diameter	13.752 cm.
" width	2.73 "
" thickness	1.45 "
" radius of magnetic circuit	5.51 "
" length " "	34.62 " = *l*.
" area of section	3.9585 sq. cm.
No. of turns in primary	300 = *n*.
No of turns in secondary	200

As above we write for the test ring

$$H = \frac{4\pi}{10} \cdot \frac{nC}{l} = 0.03629\ nC.$$

$$= 10.887\ C, \qquad C = \text{current in amperes.}$$

Total cutting of magnetic lines = $H \times 200 \times 3.9585 = 791.7\ H$.

In taking the magnetization curves the "reversal" method was used in the following manner: *—the magnetizing current being commenced at its maximum value and reversed several times to bring the magnetization up to its full extent, the ballistic circuit being open during this preliminary operation, the secondary circuit was then closed and the current reversed while the double induction was measured by the galvanometer throw. The current being then slightly reduced and reversed several times as before, the induction was again measured on reversing the current. By continuing this process until the magnetizing current was gradually reduced to zero, data was obtained for plotting the curve. The "reversal" method has the great advantage that each point is determined *independently* of all the others, and as the final reading taken for a point was the mean of three taken for that point, the error is reduced to a minimum. The disadvantage of the step-by-step method is that each point determined depends upon the accuracy of each of the preceding points, and but one observation can be taken for a single point, besides the sample has to be thoroughly demagnetized before beginning, which is a difficult thing to accomplish even with a powerful alternating current source at hand.

The two methods give curves of substantially the same character, except that the induction values are slightly higher by the reversal method. On account of the enormous vibrations which gun steel is subjected to during firing, the reversal method probably gives values too low instead of too high, which is an additional reason for employing this method.

A number of sets of observations were taken in this manner and the set given below determines the curves plotted in Figs. 1, 2, 3, and 4. Each point was determined by three independent observations agreeing very closely with one another and only these mean observations are here recorded. The standardizing coil was read a number of times before and after the test ring observations, and the mean of these used for the calculations. The galvanometer was shunted in this case so that the maximum readings just remained on the scale. The following observations were taken:

*The magnetic permeability of special irons for electrical purposes. Transactions of the American Institute of Electrical Engineers. Vol. IX. Nos. 5-6.

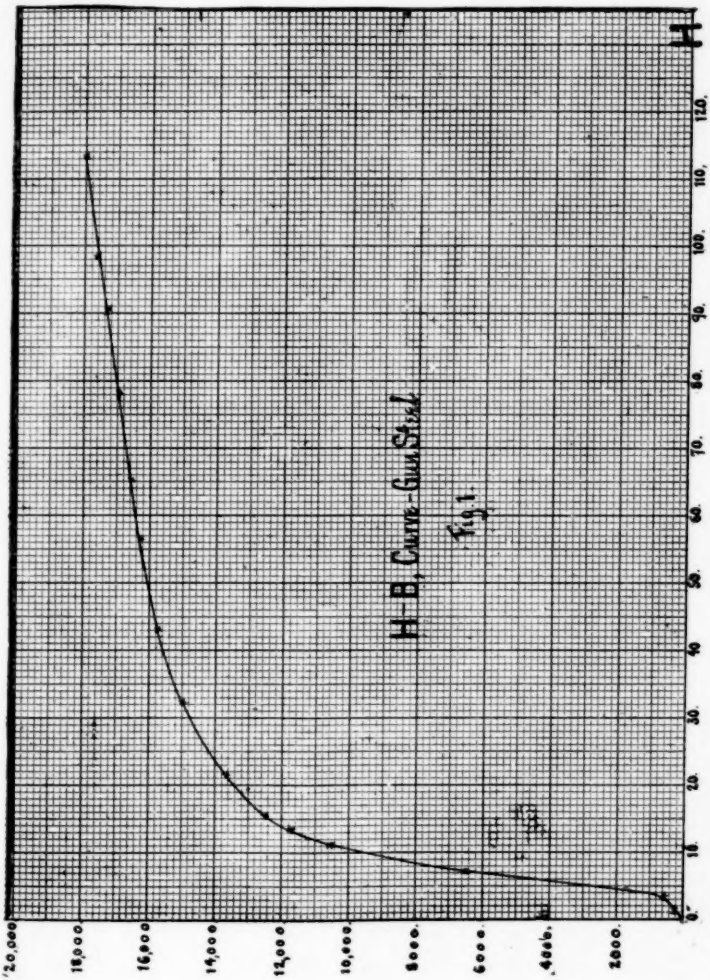
Mean current throught standardizing coil—13.194 = *C*.

Mean galvanometer throw standardizing coil—4.00 scale divisions.

From constants of this coil already given we write:

Total cutting of magnetic lines

equal 10,742.45 $C = 141{,}735.92$.



1 scale div. = 70,867.96 lines cut.

For test ring we have, since $\frac{70{,}867.96}{791.7} = 89.51$,—

Induction in test ring = 89.51. gal. throw = B = number of lines per sq. cm. induced in the iron ring.

In the curve Fig. 1 abscissæ are magnetizing forces H, and ordinates are corresponding inductions B, both expressed in absolute C. G. S. units.

To reduce values of H to ampere-turns per centimetre length, which are much used by engineers, it is only necessary to multiply any value of H taken from any of the curves by 0.7950 or practically .8 and if readings are wanted in sq. inches instead of sq. cm. multiply values of H or B by 6.45, μ and ρ being ratios are not affected by the system of units.

TABLE I. GUN-STEEL BY REVERSAL.

Amperes in magnetizing circuit.	Values of H.	Galvanometer throw.	Values of B.
10.400	113.22	201.68	18,052
9.025	98.25	197.21	17,652
8.325	90.63	193.20	17,293
7.191	78.27	189.65	16,975
6.025	65.32	185.25	16,581
5.208	56.61	181.68	16,262
3.948	42.98	176.01	15,754
2.963	32.25	167.58	15,000
1.970	21.44	152.66	13,664
1.407	15.32	139.41	12,478
1.240	13.50	131.50	11,770
1.025	11.15	117.35	10,503
0.670	7.30	71.58	6,407
0.313	3.40	6.01	537
0.155	1.68	2.42	216

The curves Figs. 2, 3 and 4 derive from the relations

$$\frac{B}{H} = \mu = \text{magnetic permeability.}$$

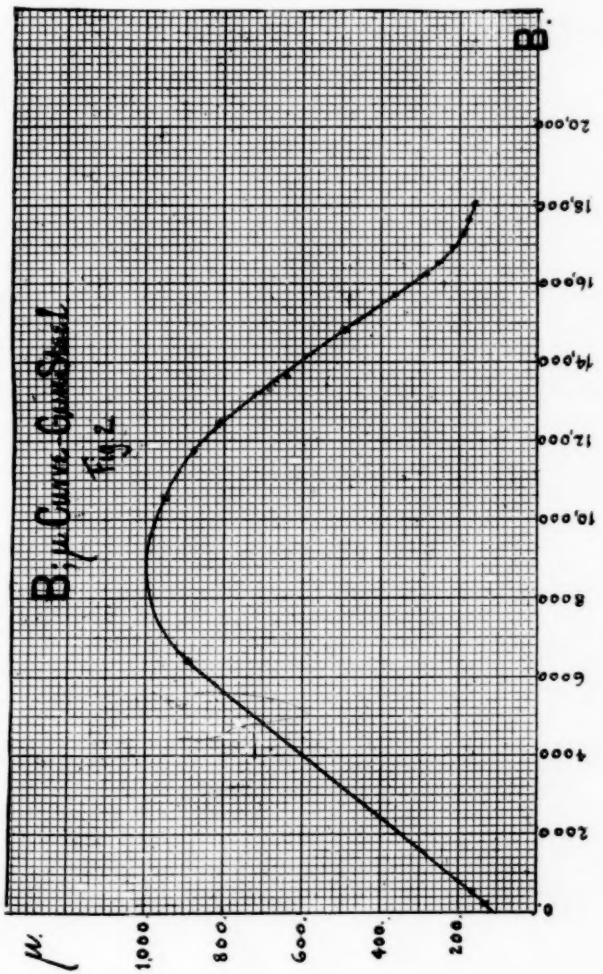
$$\rho = \frac{1}{\mu} = \text{magnetic reluctivity.}$$

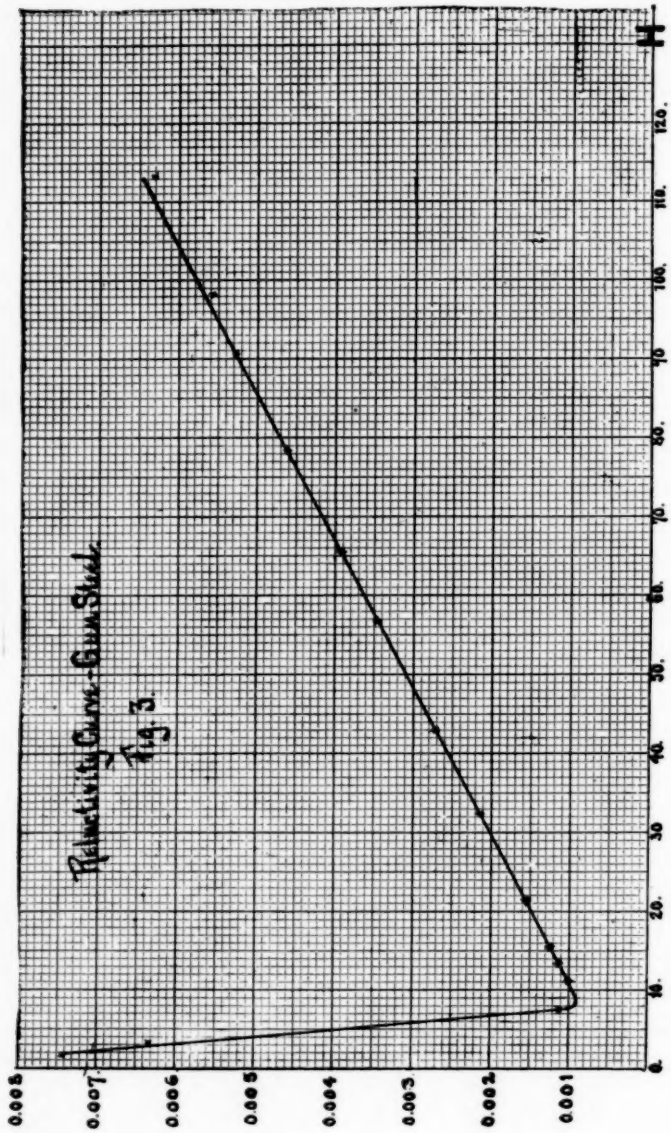
μ and ρ are here taken in their ordinary sense and values of the

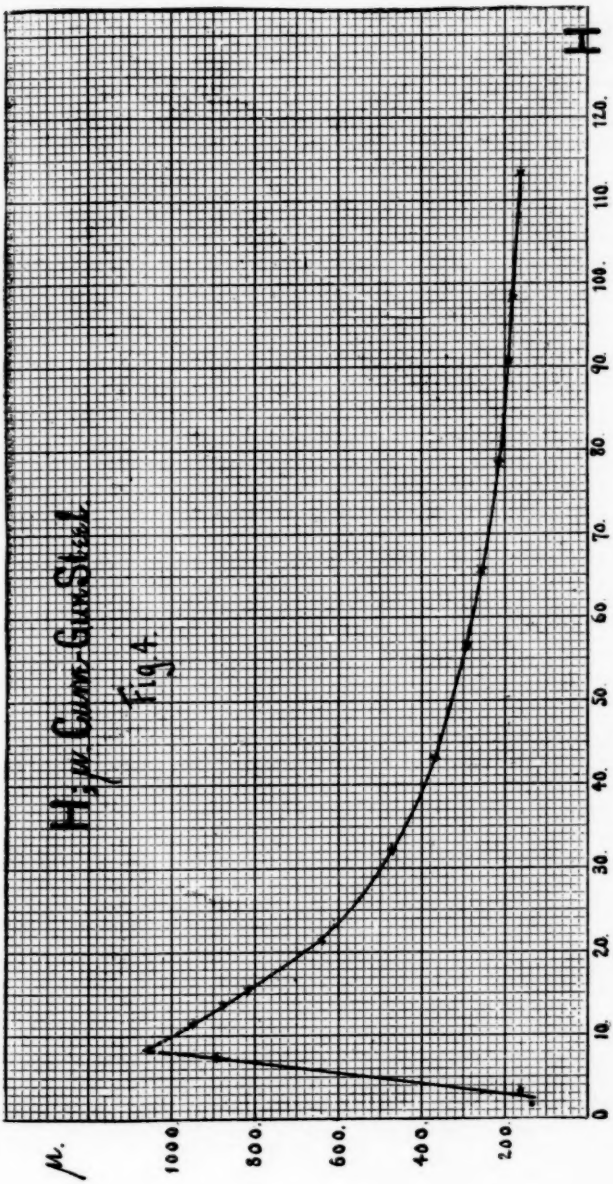
metallic permeability and reluctivity as distinguished from *apparent* values would derive from the relations

$$\frac{B-H}{H} = \mu = \text{metallic permeability.}$$

$$\frac{1}{\mu} = \rho = \text{metallic reluctivity.}$$




Reluctivity Curve - Gun Steel
Fig 3.
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.
10.
20.
30.
40.
50.
60.
70.
80.
90.
100.
110.
120.


H. & W. Comp. Gun Steel.
Fig 4.
μ.
1000
800
600
400
200
0
10
20
30
40
50
60
70
80
90
100
110
120
H

This difference, however, would not be perceptible in the curve Fig. 3, and only shows itself for large values of H. As has been pointed out by Mr. Kennelly* the reluctivity curve is practically a bilinear one with a more or less sharp "elbow" depending upon the softness and purity of the iron. The critical reluctivity for gun steel is seen from the curve to be for values of H between 7 and 10 while the falling of the plotted points below the right line as H gets larger, is also exhibited as Mr. Kennelly found.

The interest which attaches to reluctivity is its analogy to ordinary ohmic resistively in a voltaic circuit, and this curve as well as the relation of Fig. 4 is given simply for completeness since Figs. 1 and 2 exhibit the curves most used in practice. We have for a voltaic circuit Ohm's law,

$$\text{Current} = \frac{\text{Electromotive force}}{\text{resistance}} = \frac{\text{Volts}}{\text{Ohms}} = \text{amperes.}$$

and the analogous law for the magnetic circuit, —

$$\text{Magnetic flux} = \frac{\text{Magnetic-motive force}}{\text{reluctance}}, \text{ or in terms of}$$

magnetic units

$$\text{Webers} = \frac{\text{gilberts}}{\text{oersteds}}, \text{ and values of magneto-motive}$$

force and reluctivity taken directly from the right lines Fig. 3 substituted in this equation give *roughly* the inductions we find in Fig. 1.

HYSTERESIS.

A number of magnetic cycles were measured to determine the behavior of gun steel under cyclic magnetizing forces, and one of these is given with the original data for its calculation. The step-by-step method† was used and the cycle started in each case from its maximum induction in the following manner: The limits of induction for the particular cycle being de-

*Magnetic Reluctance—Transactions American Institute of Electrical Engineers. Vol. VIII.

† Professor Ewing has recently devised an improvement upon this method for taking cycles by which each point is determined independently.—*London Electrician*, April, 1894.

cided upon, the magnetizing current was reversed many times as in the "reversal" method already described, to bring the magnetization to its full value, then the magnetizing current remaining unbroken, successive small resistances were introduced in its circuit and the corresponding throws measured. When the magnetizing current was reduced to zero in this manner, the switch was reversed and the current successively increased in the negative direction until its value became equal to the positive force corresponding to the initial point. This evidently defines the complete cycle since the return limb is symmetrical with the semi-cycle observed, and was taken simply to check the results.

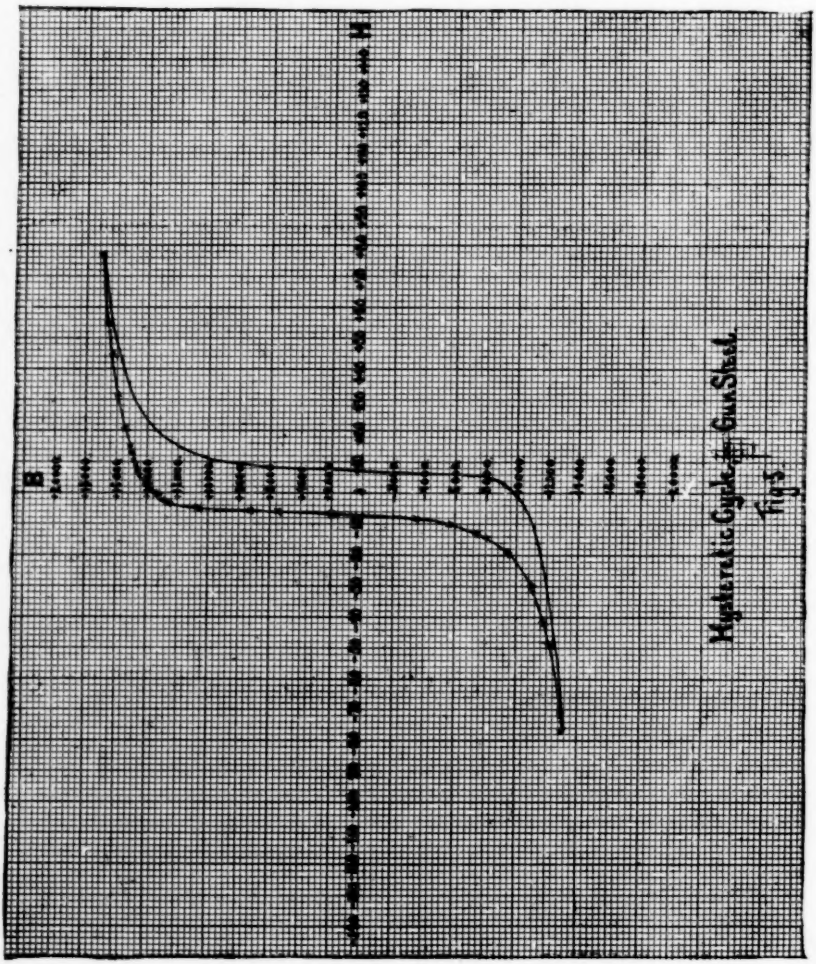
TABLE II. GUN-STEEL BY REVERSAL.

H.	B.	μ.	ρ.
113.22	18,052	159.4	.006289
98.25	17,652	179.7	.005556
90.63	17,293	190.8	.005236
78.27	16,975	217.07	.004608
65.32	16,581	253.9	.003937
56.61	16,262	287.3	.003484
42.98	15,754	367.2	.002725
32.25	15,000	465.8	.002132
21.44	13,664	638.5	.001567
15.32	12,478	815.5	.001227
13.50	11,770	878.3	.001139
11.15	10,503	946.2	.001057
7.30	6,407	890.0	.001124
3.40	537	157.9	.006329
1.68	216	135.	.007407

The induction corresponding to the initial point was taken from the curve, Fig. 1.

The galvanometer could be made much more sensitive in these cases and was used unshunted, since successive small changes of induction are measured instead of large double inductions as in the reversal method, and the limits of the scale are available for measuring these small inductions, thereby permitting much larger standardizing deflections being obtained, with consequent increased accuracy.

The observations for the curve, Fig. 5, were as follows:
Standardizing coil, mean current = 8.652 = *C*.
Mean throw (double) 21.28.
$H = 11.873\ C.$
Total cutting of magnetic lines = 10,742. 45 *C*.
= 92,943. 677.



1 scale division = 8,735.3 lines cut.
Therefore for test ring we have as before

$$\text{since } \frac{8{,}735.3}{791.7} = 11.03,$$

$B = 11.03$. ballistic throw.

TABLE III. HYSTERETIC CYCLE.—GUN STEEL.

Amperes in Magnetizing Circuit.	H.	Throw.	Sum of Throws.	B.	Ordinates.
7.05	+ 76.75	38.7	38.7	425.7	+17000
5.04	+ 54.87	20.8	59.5	654.5	+16574
4.10	+ 44.636	34.6	94.1	1035.1	+16345
2.9	+ 31.57	41.3	135.4	1489.4	+15965
1.9	+ 20.68	30.8	166.2	1828.2	+15510
1.39	+ 15.13	0.4	166.6	1832.6	+15172
1.34	+ 14.59	12.1	178.7	1965.7	+15167
1.165	+ 12.68	11.3	190.0	2090.0	+15034
0.97	+ 10.56	14.1	204.1	2245.0	+14910
0.81	+ 8.82	17.7	221.8	2439.8	+14755
0.625	+ 6.80	5.7	227.5	2502.5	+14560
0.56	+ 6.09	4.1	231.6	2547.7	+14497
0.525	+ 5.71	10.5	242.1	2663	+14452
0.44	+ 4.79	.5	242.6	2668.6	+14337
0.445	+ 4.84	18.8	261.4	2875.4	+14331
0.3	+ 3.26	10.9	272.3	2995.3	+14124
0.22	+ 2.39	11.8	284.1	3125.1	+14005
0.147	+ 1.6	9.4	293.5	3228.5	+13875
0.97	+ 1.056	2.6	296.1	3257.1	+13771
0.08	+ 0.871	17.2	313.3	3446.3	+13743
0.00	± 0.00	20.0	333.3	3666.3	+13554
0.08	— 0.871	3.1	336.4	3700.4	+13334
0.097	— 1.056	13.5	349.9	3848.9	+13300
0.146	— 1.6	25.3	375.2	4127.2	+13151
0.22	— 2.395	33.0	408.2	4490	+12873
0.295	— 3.26	177.1	585.3	6438	+12510
0.445	— 4.84	296.5	881.8	9699.8	+10562
0.523	— 5.69	158.9	1040.7	11447.7	+ 7300
0.565	— 6.09	323.3	1364.0	15004	+ 5552
0.636	— 6.924	507.3	1871.3	20584.3	+ 1996
0.80	— 8.7	190.3	2061.6	22677.6	— 3584
0.935	— 10.18	161.3	2222.9	24451.9	— 5677
1.18	— 12.84	0.6	2223.9	24458.5	— 7452
1.2	— 13.06	53.0	2276.5	25041.5	— 7458
1.3	— 14.15	134.5	2411.0	26521	— 8041
1.8	— 19.59	134.4	2545.0	27999.4	— 9521
2.75	— 29.94	72.6	2618.0	28798	—10999
3.85	— 41.9	37.6	2655.6	29211.6	—11798
4.5	— 48.99	63.0	2718.6	29904.6	—12211
6.6	— 71.85	114.0	2832.6	31158.6	—12904
12.7	—138.26				—14158

The area of the curve, Fig. 5, represents the energy dissipated in performing the cycle due to hysteresis proper, and this area was determined by means of a planimeter to be

955 sq. cm.

The work performed in magnetizing the specimem to an intensity I is evidently,

$$\int HdI, \text{ or since } B = H + 4\pi I,$$

$$\int HdI = \frac{1}{4\pi}\int HdB.$$

$\int HdB = 9.55$ sq. cm. $= 473{,}689.947$ ergs on the particular scale of Fig. 5.

Steinmetz' Law of Hysteresis is expressed by the following empirical formula:

$$\eta\left(\frac{B_1 - B_2}{2}\right)^{1.6} = \text{loss of energy in ergs. per cycle, and } cm^3 =$$

10^{-7} joules $= 10^{-7}$ watt-seconds, in which B_1 and B_2 are the limiting values of the magnetic induction between which the magnetic cycle is performed, and η a coefficient depending upon the particular metal. From Fig. 5 we have for the cycle under consideration

$$\begin{cases} B_1 = +\,17{,}000. \\ B_2 = -\,13{,}000, \text{ or substituting, we have} \end{cases}$$

$$\eta \times 15000^{1.6} = \frac{1}{4\pi}\int HdB = 37{,}695.4$$

$$\therefore \eta = \underline{0.007844}.$$

or .008 approximately as the hysteresis constant for gun steel.

This formula which Ewing has recently shown* to be but an empirical one, possessing no physical significance is nevertheless very serviceable, especially in cases involving alternating currents such as in transformer design, since it gives close approximations over the range of B usually employed in practice.

* *London Electrician*, April, 1894.

RESULTS.

The foregoing very superficial tests indicate that the steel of our new guns, besides possessing remarkable physical qualities, also has excellent magnetic qualities, and but for the cost could be used for the construction of electrical machinery with very efficient results. In fact, a comparison of the curve Fig. 1, with Hopkinson's curve for the best wrought-iron shows them to be practically the same in character, and when further compared with the curves for the average steel *castings* * from various manufacturers in the United States, we find magnetic values about 8 per cent. in favor of gun steel. This indicates an improvement produced by forging as compared with simple steel castings, and for marine dynamos, and in gun-training motors when space is valuable, steel of high permeability will, probably, be exclusively used in the future.

Passing to the hysteresis behavior, it is observed that the curve Fig. 5 is of the characteristic "square-shouldered" type, which is often found in steel and almost always in annealed soft iron. This bend in the curve, which is not a decided "knee" in this case, divides the curve into two parts, corresponding to the stable and unstable conditions in Ewing's theory. The rate of descent from the bend during the reversal of the magnetism is remarkably rapid and uniform, while the comparatively small area inclosed shows the effect of annealing.

Hardening steel increases hysteresis loss so that samples with exactly the same chemical constitution show very different losses, depending upon whether they have been annealed or hardened.

The bend in the curve being very slightly on the negative side of the axis of B shows that when the force is zero the remaining magnetism is still in the saturation part of the curve and therefore in stable equilibrium, indicating that the remaining magnetism is rather persistent and comparatively difficult to destroy.

The hysteresis formula from these tests becomes

$$W = 0.0078 \left(\frac{B_1 = B_2}{2} \right)^{1.6} = \text{energy dissipated}$$

in ergs per cycle and $cm^3 = 10^{-7}$ watt-seconds.

* Cornell Experiments.

This value of $\eta = .0078$, places gun steel, as expected, between average wrought-iron ($\eta = .003$) and average cast-iron ($\eta = .013$) as given by Steinmetz's researches.

An accurate hysteresis constant is obtained only after the examination of many specimens of the metal and averaging many cycles, but the value given is submitted until it can be corrected by further tests.

From data which has but recently come to hand it would appear that there is a connection between the magnetic qualities and the physical conditions of steel as indicated by a combination of high physical qualities, for instance, nickel steel possessing in an unusual degree a combination of high elastic limit and ductility, is also found to possess exceptionally high magnetic permeability.

Since chrome steel and nickel steel are just now attracting much attention as a metal for the construction of *cannon*,* as well as for armor and projectiles, the above fact assumes a military as well as a commercial interest.

* Captain Gaston Moch—"A General Review of Existing Artillery." Chicago International Congress paper.

CULTIVATED AMERICAN GRASSES AND HERBAGE, USED FOR PASTURAGE AND HAY.*

By Major W. C. FORBUSH, 9th U. S. Cavalry.

IN view of the importance and necessity for the use of the horse in our conduct of the Military Art, there are certain lines of investigation which pertain to the duties of the cavalryman, which render it imperative that he should acquaint himself thoroughly with everything that embraces the efficiency of his arm, which keeps it up under severe trials and hardships, which recuperates it after disaster or defeat, and which, over and above the ordinary service of his mount, enables us to obtain a stronger, better and further use of him. Without this knowledge, the uses of our special arm become paralyzed; its efficiency upon the theatre of war becomes imperilled; and by breaking down of its means of locomotion its usefulness ends, and disaster is entailed upon the operations of the entire army.

My subject for consideration is "Cultivated American Grasses and Herbage, used for Pasturage and Hay."

In treating of this subject, I shall endeavor to present the experience of some of our oldest writers, and, to that extent, this essay will be somewhat of a compilation. To this is added the acquired wisdom obtained from the experience of daily contact with some of our most noted cavalry leaders for the quarter of a century already closed, during the period when our great North American Desert was but a roaming ground and pasture for herds of buffalo and wild horses.

American grasses belong to two distinct classes. Those which have been developed by science from the wild state, to a more nutritious and satisfying food for animals, and which are known as domestic or cultivated grasses; and those which exist

* This essay was forwarded, under existing regulations, to the Military Information Division of the Adjutant General's Office, and is published in the Journal of The Military Service Institution by permission of the Adjutant General. The publication of the essay is not to be understood as a mark of official sanction of the opinions expressed therein, the author being alone responsible for the views set forth in his paper.

in a wild state on our uncultivated areas. They are also divided into those which are self-cured while standing, that is, those in which the nutritious qualities of the grasses remain in the stalk after the seed has been formed, and are not susceptible to the action of the weather, being valuable for pasture during the winter months; and those in which the food properties of the sap, as soon as the food has matured, go back to the root, leaving the stalk but so much woody fibre, worthless as food material except for use as roughness, to aid digestion where grain is fed. In order to utilize this last mentioned class of grasses for hay they must be cut while in full flower, or while the seed is in a condition of paste, and the stalk is full of succulent sap to furnish the requisite materials for the seed. It is then properly cured and finally stowed away from the action of the weather ready for use. It is a well-known fact that horses prefer that which is composed of a great variety of grasses which are good, than that of a single variety, even if it is much better. They thrive upon the variety of diet.

Plants, like the clovers, mixed with the grasses called herbage, make the forage sweet, wholesome and they tickle the palate. It is relished better than pure hay. I should explain, at this point, that herbage is composed of all those plants which are not weeds, other than grasses.

The self-cured grasses, which furnish grazing of an excellent quality for the winter months and take the place of hay, are the different varieties of gramma, some dozen or more in all, the black bunch grass, common bunch grass and filaree, wild rye or wild wheat, mesquite leaves and the white sage after frost. Those which it is necessary to cut while the sap is in the stalk and before the seed has been formed, in order to be utilized as hay, are timothy, red-top and blue grass, which are the best, and which are found in both wild and cultivated states. These with the clovers (red, white, yellow and a hybrid variety, besides Japan clover and alfalfa, all of which are known as herbage, when mixed), make the most desirable long forage used.

After these come the wild varieties, rye-grass, blue-stem, blue-joint, wild oats, white gramma, Bermuda, rescue grass, canary grass (American), velvet grass, Texas blue grass, Texas

millet, Austin grass, Guinea grass, Para grass, beggar-tick and Louisiana grass; the plants, Mexican-clover and teosinte, with quite a variety of annual grasses grown in the extreme south. The sacaton and guyatta grasses of New Mexico and Arizona should not be omitted, and barley, oats, sorghum, sugar cane, the bark of all the varieties of the poplar tree, slippery elm, willows and the Soy bean, of Japan, have a place.

The cultivated grasses of America are limited in number. The custom is to sow one or two standard varieties with clover, raise hay for a few years, as long as the crop is a strong one, and then use the fields for pasture till the time arrives for cultivation again.

We rarely sow grasses for pasture in America, and consequently the best grasses for this purpose are not used. This accounts for our pastures being inferior to those of England.

Timothy stands at the head as a hay grass in this country, where it was first brought into notice for this purpose, though it is not thought of for use as pasturage. Its yield of hay is much heavier than any known variety, and its seeds are exceedingly nutritious. It is a question of much doubt, though it is generally believed to have come originally from Europe or Northern Asia; at least it was first known there, where it existed centuries ago, from the Arctic regions of the north to the Mediterranean Sea on the south. It has been known as "Cat's-tail-grass," in England, from time immemorial. Though not much valued by the Britons, it has been considered as a native of their meadows.

The name, Timothy, is of American origin, and goes back to Timothy Hansen, who cultivated it in New York, prior to 1750, afterwards in Maryland, and finally took the seed to North Carolina. It was found growing in a New Hampshire swamp over one hundred and seventy years ago by a man named Herd, who cultivated it and gave it its name of herdsgrass throughout New England. It is possible the American grass is a variety of the European species, which has undergone changes due to climate and soil. The English "cat's tail" has a spreading and creeping root, while our timothy is tuberous. It has more nutrition when ripe than any known grass, being especially well equipped with nitrogen and fats, making it especially well

adapted for horses intended for fast work. This is due to the seeds, which weigh about forty-eight pounds to the bushel, and as many as forty-five bushels to the acre have been produced. It is most productive on a moist, clay-loam soil, but if highly fertilized in a lighter soil, it does equally well. It is usually sown with clover, and has been known to yield, in Western North Carolina, six tons to the acre. In late years a species of this grass has been found wild on the mountain ranges of America.

Italian rye-grass is the most prominent of all the grasses, considering production, where the conditions are adapted to its growth. In Italy it is irrigated, and is fed as a green forage. Its yield is enormous. It is alleged that eighty tons to an acre are produced in a single season of ten months. After being cut it will grow an inch per day, a crop being taken every fourteen days throughout the growing season. There is a variety produced on dry land, claimed to be superior to the Italian species, called Pasey's rye-grass. It does well in America, and when used with other grasses, produces a pasture which outstrips all others.

Red-top is a grass akin to foul meadow. It is a finer and lighter grass than timothy, but when sown together, they make a better pasture than when sown separately. The hay is used for a change in diet for horses. It is found wild in the mountain ranges of America, and is a native of our soil.

The blue grass of Kentucky, for pasture, has a reputation attained by no grass in the United States. It belongs to the poa family, all of its species being valuable. It thrives best in a soil rich in lime, and in moist localities, especially near springs, and where the ground has been irrigated. The meadow blue grass is the variety known to fame. Its nutritious qualities produce Kentucky beef, which excels that raised on English meadows, and Kentucky thoroughbreds beat the world. It was brought from England to America. It takes three years before it becomes a grass from the seed, but once rooted it maintains its hold, whether subjected to heat or cold. Foul meadow is a first cousin to blue grass.

Clover is the oldest of all plants known to agriculture. It has been raised in China, and the countries of Central Asia, ever since

agriculture has been known among the original races. It advanced, gradually, with civilization towards the west. It was highly valued by the ancient Romans, who used it as green forage. The Romans distributed it over Europe as far as Britain. It is spoken of by Pliny on account of its habit of folding its leaves before a rain. It was introduced by him as an example of plants possessing the power of sensation, if not with the faculty of sense. It was his belief that all plant life is endowed with sense as well as animal. The Chinese at first used this plant for food and also as a fertilizer to be plowed under, later it came to be held as valuable for fodder as well, especially by the farmers of Rome, who extended their knowledge through the conquered provinces. From its description, it was the red clover of to-day, a biennial plant, with a deep, thick root and luxuriant foliage. There are five distinct species in cultivation : common red, perennial red, or pea-vine, the annual, known as scarlet (used for green fodder and hay, as well as fertilizer), white clover, grown principally in Holland, Alsike, or Swedish variety, a hybrid between the red and the white. The first two are the most prized for forage and fertilization. The biennial matures its growth and seeds the second year, when it will yield a fine crop of hay, the same season a crop of seed, the next season it can be pastured and then turned under to supply the next corn crop with a growth stimulant of nitrogenous properties, which appear to advantage in the results at harvest. These nitrogenous properties are derived from the clover roots. The value of the clovers as fertilizers has been determined only by recent experiment. It is alleged that this quality is due to an indirect action of a special germ, which lives and grows in the roots of these plants, forming "nodules or tubercles." In these there is gathered a large quantity of nitrogen taken from the atmosphere. This recent discovery explains an unknown property of Nature, and we find ourselves in the use of what has been supposed to be a "neutral, inactive or negative element of the atmosphere." It has been determined that this nitrogen of the atmosphere is the "source of all the organic, nitrogenous substances of Nature," and the following explanation is given as to the manner in which it becomes organized for use. "This germ belongs to a class of minute organisms known as bacteria, which exists in

all fertile soil, and is especially abundant where decaying vegetable matter is found in considerable quantities, and upon which it feeds. In this use of it, it is reduced to its original elements. While this change is going on, the germ takes in nitrogen from the air and combines it with oxygen, forming nitric acid, which in this state is immediately combined with whatever there is of alkaline matter in the soil." This explains how it happens that lime in the soil is so beneficial to clover, and enables it to yield so large a crop. Still further it is seen that this lime seizes upon the nitric acid, formed by this germ from the nitrogen of the atmosphere, and holds it in the soil, where it can be slowly dissolved, or combined with other alkaline matters. At any rate it is a most valuable stimulator to the growth of plants. All members of the clover family are endowed with this ability to enrich the soil. The perennial is considered to be the best for this purpose, while the scarlet at the south is very valuable, and is outgrowing the prejudice against it. The Swedish species is best for milk, through the cows, and for honey through the bees. Alfalfa is a member of the clover family, but it differs from them. This is the Spanish name for it which has extended to America. It was taken to California from Chili, and a great success was achieved in its growth there, until to-day its harvest throughout the country west of the Missouri River is an extended and successful one. It is known in Switzerland as Lucerne. It is a native of Asia, and has been known to agriculture as long as clover. In South America it has spread over vast areas in a wild state. When irrigated it will produce, in California, four crops in a single year. As a green fodder it has to be fed with care to prevent bloat, or hoven, in cattle, but as hay or in a wilted state it can be used with safety with all animals. It is a perennial and valuable in the west. Its value as a fertilizer, from the nitrogen it takes from the air to the soil, makes it of great use in developing the grasses which with the grains induce speed in horses. With this, and through good breeding, we have developed an animal in the standard horse from which we have much to expect in the future.

Throughout New England, the Middle States, the Western States as far as the Missouri River, and that portion of the Southern States which are north of a degree of latitude through

the central part of the State of Georgia, and as far west as Texas, grasses of the best matured varieties have been under cultivation to such an extent and for so long a time that the long forage, within these limits, consists of the best materials known to agriculture in their respective latitudes.

The cultivated grasses of the extreme south and the forage plants which are grown there are in such a state of unmatured experiment that no attempt will be made to consider them at present, but with wild varieties of grass which enter into the long forage materials in the vicinity of our military posts, besides the wild grasses and plants of the arid regions of the far west and southwest, will be reserved for a future essay.

The value of hay depends more upon the soil in which it has been raised than at first thought might be imagined. The best hay for horses which are to be used for fast work is grown on upland soil, for the reason that the most nutritious grasses are found only in upland meadow, or cultivated fields. Much depends upon stage of growth when cut. The best hay is known by the fineness and firmness of the stalks and stems, by its narrow leaves and by the appearance of grasses and herbage in the hay, never seen in the lowlands. The manner in which the grasses are cured and stowed away for use are potent factors in its value. Lowland hay is known by the coarseness of the stems and wide leaves. Water meadow, by the water grasses which look like flags in their growth. Horses should never be fed on this kind of hay. It is a favorable sign of good hay to find in it flowers which are in full bloom, as butter-cups and red clover, as it is a pretty sure test that the grass has been cut early in the season; also that the early grasses in it have not gone to seed. All authorities agree that hay should not be kept longer than a single year. If hay has been cut too late, or improperly cured after it has been cut, it is often spoiled even if composed of the best of grasses; this may be due to wet weather, or it may be the spring grasses have partially failed, and with the hope of securing a better return in the autumn, the spring grass is allowed to go over till the fall rains, thus mixing worthless spring hay with good autumn hay. To cure hay properly, in these days of improved machinery, after it has been cut and wilted, the tedder should be put to use at once and continued

till it is time for the afternoon raking, when it should be gathered into windrows, and if the barometer indicates rain, or if it is a country of heavy dews, it should be placed in the cock before nightfall. Any considerable degree of moisture falling upon hay when it is nearly cured makes it lose its perfume, and its nutrition is seriously impaired. Rain does not seriously affect new-mown grass, of itself, before it has been wilted, but after this stage it affects its color, its sugar, and other properties.

After curing as soon as possible, hay should be housed or stacked. In the army hay is stacked on account of the great quantities which are consumed. Every contractor, or expert stacker in the contractor's service, will insist that the stacks should be from twenty-two to twenty-four feet wide at the base. They will interpose all sorts of objections to keep from the additional labor of building small stacks. In a wide stack, the imperfectly cured grasses with heavy stalks, among an inferior quality of hay, are oftentimes lost to the eye of an inspector, who at the time is looking at good hay, when loads are being delivered at several points of the stack at the same time. The stems and joints of much of the hay delivered at army posts are too green, while the leaves, culms and flowers are cured, such for instance as blue-stem, blue-grass, rye-grass, broom grass, wild oats and purple three-awned grass. The result is that the stack heats, becomes mow-burnt and consequently ruined as feed for animals. Horses are inclined to hay which has been slightly mow-burnt, but it affects the kidneys so seriously that it is an unsafe forage. It has been determined by experiment in the Fifth Cavalry, that stacks for well cured, fine, or spring grasses, should not be over sixteen feet wide at the base, and for heavier grasses which mature after the fall rains and are cut in September, the stacks should not be more than fourteen feet wide at the base. This is as narrow as it is practicable to build a stack and have it stand well. It often happens that some of the hay in the interior of a load has not been properly cured. In a small stack of the above dimensions, it has been ascertained that this hay will sweat out and cure in the stack, and the entire lot when opened for use will be in good condition. In a small stack the air will penetrate to a distance of from seven to eight

feet on each side, before it has become settled, and while the final curing process is in operation. Stacks should be well raked down, topped out and raised a little in the centre, before leaving them to the action of the weather. Roofing of corrugated iron should be provided at all of our military posts, furnished in sections, so that they can be joined together and keyed, the whole held in place by telegraph wire pinned to the stack, or weighted, to protect the stacks. All stacks should be ditched.

In order to preserve hay in the stack so that it will be well relished by horses in winter, from two to three quarts of coarsely pulverized salt should be scattered over each ton of hay while it is being stowed away. This salt will dissolve and become taken up by the hay, stop any ordinary fermentation which might arise, if a little green, thus preventing waste, and when fed to the animals will furnish them with a forage seasoned to the requirements of their animal life.

I have endeavored to present this subject as completely as possible, in the interest of our horsemen and food suppliers in the field, and to show that a knowledge of it is of no small importance in the evolution of the animal which is the motive power of our special arm.

Lines of operations on the theatre of war are no longer confined to great interior water-ways, or mountain ranges of a country, but trunk lines of fortified railways, with numerous feeders, will be added to the list, in future contests for national supremacy, so that large bodies of men and all the supplies, munitions, and paraphernalia of war, can be concentrated at any threatened point of attack in the shortest possible limit of time.

In these days of smokeless powder and the certain accuracy of our new fire-arms, the approach of hostile forces upon the field of battle will be rendered more difficult as time advances.

In the face of all this nothing has as yet been devised or spoken of as a possibility, however remote, which will supplant the contact squadron in its duties pertaining to the eyes of the army; but rather the screening and information duties, as well as the advanced security of an army, will depend upon the man on horseback with tenfold more potency and responsibility than ever dreamed of before. The only fear is that information ordered to be gained will not be reliable, due to difficulties in

obtaining it, and the consequent "taking of things for granted."

All the phases of battle will be the problem to be met and solved by our cavalry of the future, with an ability to take hold and keep the vital points of situation in the first stage of an approaching conflict, till the infantry can be brought up to make fast and permanent the advantages thus gained, leaving the cavalry still free to make more decisive, by its versatility of action, the fruits of victory if won, or cover more completely the broken fragments of disaster if lost. Whatever happens, however, it should always be borne in mind that advantage is a better soldier than rashness.

In future wars the horses for use must have been developed by breeding to something more than an animal which will break down at the ordinary requirements of the battle-field. The men, too, must be trained in specialties, those which will give them the greatest speed, strength and endurance on the theatre of war, added to an intensity of energy which gives a confidence in time of action that nothing can push aside—which is irresistible.

In these days of long distance riding, trained bodies of horse "can cover four thousand yards at a walk, four thousand more at a trot, and still four thousand more at a gallop and full speed," arriving at the finish with troopers in a fit shape for business and full of fight. This is what will be demanded of us in the future. Unless we can meet these requirements as cavalrymen, we shall have no place in the battles of the future.

In these times an imperative duty confronts us in terms beyond the use of words, that we neglect no efforts in the evolution of the horse, either by breeding, by feeding, by training, or by whatever else will insure to us a stronger, better and further use of this animal.

THE CARE OF THE SOLDIER IN CAMP, GARRISON AND THE FIELD.

By Captain H. S. T. Harris, Assistant Surgeon.

IN a discussion of this subject we must go over a good many facts which are well-known to all of us. Such a repetition of what may well be called trite truisms is necessarily dry, but not necessarily unprofitable. Too often our theoretical knowledge is not kept at hand for daily efficient use, but is safely stowed away in some corner of the mind, only to be hauled out for exhibition in lyceum discussions or examinations for promotion.

The famous Dr. Arnold, of Rugby, tried to induce in his scholars a habit which he called *moral thoughtfulness.* With the morals of my readers I am in no wise concerned; but if the perusal of these pages, should beget, in the few who may have the patience to wade through them, a habit of *sanitary thoughtfulness*, then would this paper have accomplished its highest purpose?

It is not within the scope of such an article to dwell at length upon the communication of diseases through an impure water supply. It suffices to say that typhoid fever, cholera and dysentery are usually propagated in this way, and that malaria frequently owes its origin to the same cause.

Given a choice of waters, what is the best source of supply? The works on hygiene rank them as follows:

Wholesome	Spring water, Deep well water	Very palatable
	Upland surface water	Moderately palatable
Suspicious	Stored rain-water	
	Surface water from cultivated lands	Palatable
Dangerous	River water to which sewage gains access, Shallow well water	Palatable

Spring water is generally pure, though in limestone formations it is apt to be hard. The purity of rain water depends

upon the cleanness of the surface from which it is collected, and upon the manner of its storage. It is best stored above ground, and if it is stored below the surface, the cistern should be entirely impervious to impurities from the surrounding soil. The character of the watershed which a river or stream drains should be a matter of careful attention, when it is selected as a source of water supply, with special reference to the possibility of sewage contamination. Shallow wells are usually filled with impurities from the surface, and any well will drain a radius of four times its depth, according to Nother and Firth.

The amount of water required for troops in garrison, with baths and sewerage, is estimated at twenty-five gallons per head. Woodhull states that a man on the march drinks from six to eight pints a day, and needs the same amount for washing his person. Horses require from six to ten gallons for drinking, and three gallons for police purposes.

With reference to the location of posts or of camps, temporary or permanent, we know that hill tops are to be avoided as too exposed. The bottoms of deep valleys as probably damp, and ravines as both damp and subject to alternating currents of hot and cold air.

Ground covered with rank vegetation has a subsoil water too near the surface. Marshes and marshy grounds are malarious, as well as points lying to leeward of them. The soil should be free from organic contamination, dry and permeable, with good natural drainage in at least one direction. It should be remembered that a soil which is good in itself may be spoiled by an impervious layer, of clay for instance, beneath it, thus holding the water as in a basin.

If the foundations of buildings cannot be so laid as to be impervious, they should be raised above the surface in order to keep out soil air and dampness. Barracks should be placed lengthwise with the prevailing winds, except in the South, where they should be broadside to the wind. Nother and Firth recommend that they should generally face east and west in order that each side of the building may have sunshine at some time during the day; but Woodhull recommends a southern exposure as the best. Double walls with ventilation between, will do much to insure coolness in hot climates.

There should of course be a plentiful supply of pure water with proper means for the removal of waste and generous bathing facilities. Efficient methods for the disposal of excreta should also be employed. Parkes says that formerly the means to this latter end in European armies were most primitive, and that from this cause alone the great military nations have suffered a loss of men which, if expressed in money, would have been sufficient to rebuild and purify every barrack they possess.

Of late years the ventilation and air space of European barracks has been much improved. In the English army the bunks were formerly arranged in double tiers, and no ventilation was thought necessary. In India the men slept in hammocks almost touching each other, whereas now they have an air space of a thousand cubic feet per head, and in England of six hundred.

This latter is the minimum requirement for a good barrack, and the air should be maintained in a condition of purity by suitable inlets and outlets so arranged as to avoid the production of sensible draughts. A number of small openings serves the purpose better than a few large ones. In a room with the cubic space indicated the area of the inlets and outlets should for each be about twelve square inches per man. In cold weather the incoming air should be warmed.

A barrack should not be more than thirty feet wide to permit it being freely aired, and it is best limited to two stories, the lower for administration, dining and amusement rooms, and the upper for dormitories. Parkes describes a typical barrack room for twenty-four men. Such a room should be sixty feet long, twenty feet broad and twelve feet high. He says that the former bad English barracks were due to two causes—"first, a great disregard or ignorance of the laws of health; and secondly, an indisposition on the part of Parliament to vote sums of money for a standing army." This latter statement goes to show that they have troubles of their own in other countries just as we have in ours.

Seven privates are allowed to marry in each English company of one hundred men. Formerly a space was screened off for them in barracks—a truly interesting condition of affairs; but a munificent government has since allotted them separate

quarters, each family to have one room fourteen by twelve ; and they now rejoice in two rooms for each household.

This leads me to speak of the character of the laundresses' quarters, as they are called, in our army. Every old post has a row of dilapidated hovels, patched up with planks, canvas, wash tin or what not, which are inhabited by the married men, and which are an offense to the sight and a menace to the health of the command. I am personally inclined to the belief that the best soldier is a single man, but am not prepared to press the point ; but I do contend that if the soldier is permitted to marry he should be furnished with decent quarters.

Our barracks and quarters have generally been designed by the Quartermaster's Department, and constructed under the contract system. However efficient the officers of that department may be, the possession of a commission in it does not of itself imply a knowledge of architecture and of the principles of ventilation and heating. Public buildings in the army should be built on designs furnished by competent architects. As for construction, it would be much better if they were built by the Quartermaster's Department, instead of being let to the lowest bidder. The quartermaster would be interested in putting up the *best* building possible ; the contractor is interested in putting up the *cheapest* that will pass muster.

The neatness of our barracks is generally above criticism, but the presence of the sleep-destroying and nasty bed-bug is a standing reproach to us. When a new barrack is constructed they are brought in with the bedding of the first company which occupies it. Captain Rogers at Fort Preble waged a fierce war upon them. Every summer the men were moved out into tents upon the parade grounds in which they slept on bed sacks filled with straw, while their mattresses were aired, and the wire bunks were soaked with strong solutions of corrosive sublimate, kerosene oil or boiling water. The barracks were swept, scrubbed, fumigated with sulphur, and painted. The only result was to keep pests within reasonable limits. The captain appealed to me to suggest some fumigant which would kill them, and I tried first chlorine and then formaldehyde, on both of which the cimex lectularius seemed to thrive, and I retired from the contest, beaten at every point. Major Forbush

informs me that his former troop of the Fifth Cavalry was practically driven out of a new barrack at Fort Riley, by bedbugs, after three weeks' occupation of the building, and that they were finally brought under control by the liberal use of kerosene oil, both upon the wire bunks, and upon all cracks and crevices about the flooring and baseboards of the rooms.

The clothing of the American soldier as at present issued is very good and has been greatly improved within the last twelve years.

Wool of course from its absorptive and retaining properties is the best winter wear, but shrinks and becomes harsh in washing, especially if boiling water is used. By mixing thirty per cent. of cotton with the wool this disadvantage is largely obviated. The new style of underwear made of cotton fabric lined with wool is probably the best yet devised, and has the advantage of cheapness.

The woollen underwear issued by the Quartermaster's Department is warm but rather irritating to a delicate skin, and a change to the cotton lined with soft wool, just mentioned, would probably be of advantage. I understand that light cotton balbriggan underwear is now issued in the South. This, for summer, with the heavy wool for winter, and the old mixed woollen shirt and canton flannel drawers for spring and fall wear, make as great an assortment of weights and fabrics as could be desired.

The skirts of the overcoat are hereafter to be lined, which is certainly a change in the right direction. Many officers think that the garment should be both heavier, and longer for infantry, and that the cavalry should have a heavy pea jacket only, the legs being protected in severe weather by an extra pair of drawers.

An increase in the number of sizes of the ready-made garments has been ordered, and may prove of advantage, as they usually fit badly unless remade at the expense of the enlisted man. The well set-up soldier, however, would probably prefer to draw unmade clothing and have it fitted to him by the company tailor. The wide bottom trousers, affected by the men, are the worst possible shape. All authorities (following Parkes) are agreed that they should be narrow at the ankles and full at the hips.

Our shoes are more open to objection than any other part of the men's clothing. They are harsh, and chafe the feet, and are said not to wear well. A shoe with a low heel, a very broad and thick sole and a soft pliable upper is what is needed. Good shoes with leggings are far preferable for cavalry to boots, as the men are then ready for either mounted or dismounted work. The modern cavalryman, like the old dragoon, "fights *indifferently* on foot or horseback."

The woollen socks, blanket-lined canvas overcoats, fur caps and gloves, issued in northern climates, as well as the white duck clothing in use at the South, are only mentioned to be praised.

We have an astounding variety of head gear, including even straw hats, which are generally worn off duty in hot climates. The present forage cap is comfortable but not sightly, and the helmet is both ugly and uncomfortable. Colonel Woodhull, in his little work on Military Hygiene, advocates a cloth sportsman's hat or soft helmet with visor front and rear. Such a head-covering was proposed to the War Department by Col. W. H. Gardner, of the Medical Department, some years ago. It would be fit for both garrison and field wear and with a plume or spike screwed into the top would serve for full dress also.

In the matter of color, we are wedded to the blue by sentimental and historical considerations, but it is, next to red or white, about the worst that can be worn. Gray is said to be "traditionally offensive," but it is by far the best, both on account of its comparative invisibility and because it does not soil easily. "Death loves a shining mark," and the brass buttons and colored facings should be supplanted by concealed fastenings and black decorations on a gray uniform—a combination which is both sensible, and attractive in appearance. Because a very gallant, but sadly mistaken, body of our countrymen once wore gray, is no good reason that we should get ourselves unnecessarily killed in blue.

With regard to the physical training of the soldier:

Having selected a recruit of sound physique and good intelligence, he should be fitted for the work which lies before him, which may be of the hardest. He should be carefully inspected and his weak points determined and an effort made to bring him up to the standard in those respects (Pilcher). The weaker

members of a command must be strengthened. As "a chain is only as strong as its weakest link," so a company can only travel as fast as its poorest footmen. As pointed out by Dr. Henry G. Bryer of the Navy in a most excellent article on Military Physical Training, the exercise of muscles is attended by an oxidation of fats and carbohydrates into carbon dioxide. During continuous exercise the nitrogenous products of muscular action are largely retained in the muscle; but during the subsequent rest these waste products are carried away and an amount of nutrition is furnished and appropriated usually greater than the loss. By alternate periods of exercise and rest we thus increase the muscular system at the expense of useless fats; and, by stopping short of exhaustion, we strengthen the heart, lungs and nervous system, and prepare them for the stress they must undergo in active service.

I have been struck by the marked difference between the fine muscular development of the men of this command (Fort Washakie, Wyoming), whom I have examined for reënlistment, and the scrawny arms and flat chests of the recruits from the East; and this difference has largely been brought about by two or three months at calisthenics and in the gymnasium.

In the matter of food the American army is certainly better treated than that of any of the great military nations. Colonel Woohull, analyzing the ration in 1889, found it slightly deficient, but since then the long fought-for allowance of fresh vegetables has been added, and with judicious handling it seems to be ample as at present constituted. Dividends from the Post Exchange do much, in most garrisons, to improve the company tables.

The matter of the general mess has been considerably discussed, and the general and better opinion seems to be that the men can be more advantageously fed by companies. The company is the unit of our little army, and the general mess tends to impair the efficiency and autonomy, so to speak, of the company mess, and thus to occasion greater trouble when a command is transferred to the field.

The subject of an emergency ration has attracted a good deal of attention of later years. In all foreign armies each soldier is issued a package of some condensed water-free food, to be al-

ways carried by him and kept for an emergency, such for instance as an unavoidable separation from the wagon train. In case a short and rapid movement independent of the transportation is to be made, supplies of this sort for the required time are issued. Such foods are fit only for the temporary subsistence of a command, for though the theoretical quantities of fats, carbohydrates and proteids may be supplied, they may prove indigestible from lack of bulk, and also to be practically deficient in nutrition. The albumen in the meats has lost value from the excessive heat used in its preparation; or vegetable albumen, which is inferior to that of animal origin, has been used, to bring the food up to the standard; and they generally contain an excess of fats and salts. Another practical objection to them is that they are apt to be fermented or spoiled from long keeping or careless preparation—*vide* Dr. La Garde's amusing account of his distressing experience with a condensed bran soup and certain whole-wheat crackers.

The best known representative of this class of foods is the famous erbswurst of the Germans, which consists of pea meal, fat and bacon ground up and made into a sausage. Seven ounces constitute a day's ration. The accounts as to its utility are very contradictory.

The French and English have a condensed soup, probably quite similar to the erbswurst in composition. The British also use the well-known pemmican, consisting of beef, fat and salt, of which four ounces are supposed to represent a pound of meat. It is issued with cocoa, biscuits and honey as an "iron ration," and is highly praised.

An exceedingly able and quite an exhaustive article on these condensed foods, by Dr. C. E. Woodruff of our army, may be found in the Proceedings of the Association of Military Surgeons for 1896.

In 1896, after consideration of the subject in the different military departments, a board was convened at Washington to fix an emergency ration, and as might have been expected from the fact that it was an American board, it took a totally new departure from the precedents established in Europe. They accepted the proposition as self-evident that a radical change from the accustomed diet of troops, in an emergency, was wrong in

principle and calculated to defeat its own ends. They also considered that it was best to constitute the ration of food products constantly kept in hand by the Supply Department. Accordingly the only new constituent of the ration established by them was pea meal instead of sugar, for which saccharin was substituted. The result of their labors was promulgated in orders, Dec. 5, 1896, in which "the emergency ration for troops operating for short periods under circumstances which require them to depend upon supplies carried upon their persons" was established as follows: Bacon, 10 ounces; hard bread, 16 ounces; pea meal, 4 ounces, or an equivalent in approved material for making soup; coffee, roasted and ground, 2 ounces, or tea ½ ounce; saccharin, 4 grains; salt, .64 ounce; pepper, .04 ounce; tobacco ½ ounce. The order further states that the nutritive qualities of this ration permits its being used on half allowance, but that it will not be so used except in cases of overruling necessity, and never for a longer period than ten days; and not more than five day rations shall be carried on the person at one time.

This ration weighs about thirty-three ounces, or five days' supply would weigh a little over ten pounds, about the same weight as that of the emergency ration, consisting largely of compressed foods, prepared by Nother and Firth, for the English service, for seven days. The intention of the board seems to have been that this amount should be considered as *the* emergency ration, and as stated in the order it was believed that this full ration for five days would, if necessary, subsist troops in campaign for ten days.

The well-known hygienist, Dr. Charles Smart, of the Surgeon General's office, was chairman of the board, and he, with Captain W. C. Brown's troop of the First Cavalry, made a practical test of the ration for ten days in the summer of 1897. The results were surprisingly in favor of the new ration. The men living, and riding twenty-one miles a day, on this half ration, only lost an average of about three pounds in weight, during the ten days' trial, and actually gained an average of twenty-four pounds in pulling strength, as shown by dynamometer tests.

From this one test it would appear that the question of an emergency ration for our army has been satisfactorily settled.

An important deduction from Dr. Smart's report is the necessity for care in the cooking of the bacon, that no portion of it may be wasted, as it is in the ordinary methods of frying. He recommends that the use of the ration on half allowance be no longer limited to cases of "overruling necessity" in active service, and also that further trial of the ration be made on practice marches.

The weight carried by our infantrymen in heavy marching order is considerably less than that borne by European soldiers, except perhaps the English, who carry 49 pounds, about the same amount as our men. This is exclusive of the clothing worn. The German soldier, including clothing on his person, bears between 67 and 73 pounds. At the latter weight he carries a coffee-mill, hatchet and spade. The French soldier, 67 pounds, including a camp kettle perched upon the top of his knapsack. Russian soldier, 74 pounds, also including a camp kettle, fastened to the end of his coat by the handle. The Italians, likewise, are addicted to the camp kettle. From these few facts, I think we see that we can learn something from our foreign friends as to how *not* to do it.

Weight should be borne as near the centre of gravity as possible, or at least in a line vertical to the point of support. Our fashion of carrying the knapsack, overcoat and shelter tent back of the shoulders causes the marching soldier to continually lean forward so as to bring his load in a line with the centre of gravity. Those who have suffered under it tell me that there is a constant and painful pressure in the middle of the back, and that the straps around the shoulders cause uncomfortable congestion of the arms. I have lately read a description of a brace proposed by Deputy Surgeon General Oliver, of the English service, which slings the knapsack from the point of the shoulder. I have been unable to obtain a description of the Merriam pack, but I understand that it allows the knapsack to rest upon the sacrum and that the weight can be shifted to a new point of support from time to time. The blanket roll distributes the weight well, but must be somewhat of an impediment to respiration, and very hot in warm weather.

The weight of the blanket-bag is something over twenty-five pounds, and it seems that it ought to be carried for the soldier

whenever possible. It must add enormously to the work of a day's march. An analysis of its contents shows that they have been selected with careful thought, guided by experience. Dr. Parkes, years ago, proposing a reform in the English equipment, suggested just about what our men are carrying now. It is however a matter of history that tired men will throw away the knapsack with all its necessary contents, and that troops in war will sooner or later come down to the hard pan of one blanket, an extra pair of socks and a plug of tobacco.

To consider the weight borne by the cavalry horse: In the English light cavalry the entire weight upon the horse is about 253 pounds, estimating the rider at 144 pounds. That is, the horse carries 109 pounds dead weight, consisting of carbine and ammunition, saddle and bridle, nose bag, clothing, rations, forage, etc. I recently weighed the saddle, pad, armament and accoutrements of one of the men of troop I, 9th Cavalry, complete, save rations and extra ammunition, for active service, and found the weight to be 67 pounds. Allowing 10 pounds for ammunition and one day's rations, and deducting the 6 pounds allowed by Nother and Firth for the English horse's forage, we should still be some 24 pounds better off than the British *light* cavalry. The weight of the soldier, who presented himself for this test, was 190 pounds. A fact which leads me to say that there ought to be greater care in selecting the middle and light weight men for the cavalry.

Every one is doubtless familiar with the means to be adopted to keep men's feet from chafing on the march—washing the feet after reaching camp, frequently changing the socks and perhaps the use of the German foot-powder; or it is recommended that the feet should be soaped or greased.

Our system of company messing on the march is certainly very good. Nothing ever tastes better than the homely fare of the soldier, when eaten with an appetite whetted by a hard day's march. When a command is reduced to the emergency ration, each man would have to boil his pea soup in his own tin cup and fry his bacon in his meat ration can. Looking at the contents of the haversack, with the tin cup and canteen, one may conclude that our individual field mess outfit has probably been reduced to its lowest terms.

The location of camps has already been mentioned. Old sites should be avoided as certainly dirty and possibly infected. In active service the shelter tent, which has lately been issued of heavier material, will probably largely supplant all other canvas. The war allowance of space per man in an A tent is so small, that the men would probably be healthier, if not happier, in the shelter tents. The invention of the *tente d'abri* is usually ascribed to the French, but I find the statement in Parkes that they were used by the Macedonians.

The spacing of tents, the necessity for their ventilation and for the preservation of the purity of the soil in and about them, the protection of the men from soil dampness, drainage and the proper construction of latrines, are too familiar to require more than passing mention.

In the English Army Regulations the following excellent points are laid down as of importance with reference to camps: "1. The length of time troops are to occupy the camping ground. 2. That order, ventilation, cleanliness and salubrity are to be enforced. 3. That means of passing freely through the camp are essential. 4. That a straggling camp increases labor of fatigue duties, and impedes delivery of supplies and circulation of orders. 5. That the more compact the camp, the easier it is to defend."

Both Woodhull and Beach call attention to the necessity of care in guarding the water supply, and in preserving it from contamination. The means to be employed are, or should be, well known to all, but a rapid recapitulation of them, in conclusion, may not be amiss. A guard should be put over the supply at once. If the source is a small spring it may be deepened and walled in with stones or its outflow received in a succession of sunk barrels. A small stream should be dammed (not merely mentally, after the manner of John Phœnix); and the banks of any stream may be roughly paved with stones to prevent fouling of the water below. The water for cooking and drinking should be taken out at the highest points.

Suspicious waters should be boiled, and may be aërated afterwards by pouring back and forth from one receptacle to another many times. Precipitation of inorganic impurities may be effected by six grains of alum to the gallon, by bruised cactus

or by the tannin of tea leaves that have been used, and much organic matter will be carried down with them. Permanganate of potash, added until the water *remains* distinctly pink in tinge, oxidizes organic impurities.

These facts form the very a-b-c of military hygiene, but they can never be repeated too often. Every line officer should take a practical and intelligent interest in the matters of water supply, food and cooking, ventilation and sewage disposal. This opinion is expressed by Colonel Woodhull, somewhere in his little book—a work which I commend to all, who have not read it, as a concise but comprehensive treatise on the subject.

THE ABBOTT MORTAR BATTERY.—ITS SERVICE AND EMPLOYMENT IN ACTION.*

By Captain H. J. REILLY, Fifth U. S. Artillery.

I VENTURE to call the battery after General Abbott, because in its present state, it is the development of his idea advanced first, I believe, in 1867 when, from his experience in mortar firing in the defenses of Washington and in the siege operations in front of Petersburg he announced that the use of mortars in sea-coast defense had become essential.

Mortars, even of 13-inch calibre had been used in the Crimean War, in 1856, and their use in attacking fortifications, dockyards and cities, as at Fort Saint Philip and Vicksburg during the Civil War has demonstrated their great value† but General Abbott was, I believe, the first who proposed their

* This essay was forwarded, under existing regulations, to the Military Information Division of the Adjutant General's Office, and is published in the Journal of The Military Service Institution by permission of the Adjutant General. The publication of the essay is not to be understood as a mark of official sanction of the opinions expressed therein, the author being alone responsible for the views set forth in his paper.

† Capt. Sullivan, R. N. : Testimony before Committee on National Defenses :—Use of English 13″ S. B. mortars in Crimean War; at a range of 4000 yards; 25 shell struck Russian line of battle-ship; 4 of these penetrated the 4 decks, 3 exploding in the handling room of the magazine; she was saved from destruction only by unusual efforts of officers in charge of magazine. Authority—Duke Michael, Russian Staff.

emplacement so as to utilize their inherent inaccuracy of fire, and permit their use against the comparatively small target presented by a war vessel.

In 1869 he read a paper before the "Essayons" Club of the Engineer Corps in which he discussed their advantages and disadvantages in sea-coast defense and demonstrated that the former largely exceed the latter. As a result of his investigations he proposed at that time, the introduction of a 20-inch S. B. mortar (the experiments made with rifled mortars having been unsuccessful) emplaced in batteries of 12 each, 6 on each side of a central passage, the magazines being at each end of the battery; the mortar to throw a solid shot weighing 1070 lbs., a maximum distance of 3000 yards; to be mounted on a centre pintle carriage which revolved within an iron ring graduated to 360°, and all of them to be fired simultaneously.

In aiming these batteries the captain and lieutenant were to be in pits 500 yards apart, the lieutenant with a transit and the captain with a plane-table on which was a graduated chart of the harbor; the lieutenant was to take the angle of the target and exhibit it to the captain who would read it with his telescope, plot it by a graduated ruler, with his own angle, and the position of the ship determined, give the charge and direction to the battery; a sighting shot would then be fired, followed by the others if the prediction was correct.

His computations showed that the 20-inch shot would penetrate four inches of iron which was thicker deck armor than was carried by any foreign vessel and offered more resistance than that presented by monitors of the Kalamazoo class, which had the heaviest deck plating of any vessels in existence at that time.

The progress in metallurgy and the consequent improvement in guns and gun-carriages made possible the 12-inch mortars with the spring return carriages that we now have, with their great increase in accuracy, which, however, is yet about one-half that of the modern breech-loading rifles.

From the firing of single mortars already had, it appears that about 20 per cent. of hits may be expected in firing at a stationary ship of the average size. If the ship is moving rapidly the difficulty of hitting is enormously increased, and

General Abbott has explicitly stated that he "has never advocated the use of mortars against ships in rapid motion, but where ships are moving rapidly the accuracy of their fire suffers so much that, to make it effective, they have to reduce their speed to steerage way or come to anchor, when mortar fire becomes effective."

Even then with the mortars grouped, the difficulty of regulating the pointing, done by a number of individual gunners exists, so General Abbott in designating the mortar battery, after careful investigation of mortar fire, decided upon the form of construction we now have, a pit, with four mortars, one at each corner of a rectangle, so arranged that the fire of all is controlled by a single individual, and may be delivered practically simultaneously, so that the mortar battery becomes a huge shot-gun, any one of whose shots which hits, being fully capable of disabling its bird.

That the pieces are fully up to the work required of them has been repeatedly proven.

In Germany, for instance, a Krupp 11¼-inch howitzer was fired at a target representing the horizontal projection of an armored deck covered with 3½-inch steel, well backed with iron ribs and wood and firmly supported five feet from the ground; at a range of 3870 yards, charge 25 lbs. powder, and at an elevation of 45°, the projectile weighing 661 lbs., pierced the target, bent the supports and was found 5 feet in the ground, the angle of incidence being 46½°. Another projectile fired at an angle of elevation of 63°, struck at an angle of incidence of 66°, pierced the target, and was found 15 feet in the rear of the hole, 4 feet in the ground. Experiments were then made with a target representing the slopes of the armored decks; it was inclined at an angle of 45°, was 4.48 inches thick and was well backed, it was also easily pierced.

The danger space of a mortar shell at 4000 yards, at 45°, is only about 18 feet, at 60° it is reduced to 10 feet for a vessel 50 feet wide.

The ammunition supply for the mortar battery, as stated by the Chief of Ordnance, is to be 150 rounds for each piece. The powder is to be delivered in zinc cases, the cartridges to be already made up so that there will be no handling of loose powder.

Each case will hold four 25 lb. charges; or three 33 lb. charges; or two 58 lb. charges; or one and one-half 80 lb. charges; or one 105 lb. charge; or one 110 lb. charge.

The ranges are to be controlled by selecting the proper charges and varying the angle of elevation between 45° and 65°.

Two pattern of shells are provided to be used in action in either cast-iron or steel mortars. One 3 feet long, weighing 800 lbs. for long ranges, bursting charge 28.8 lbs. of powder or 17 lbs. of Emmensite. One 3.8 feet long, weighing 1000 lbs. for short ranges, with a bursting charge of 37.5 lbs. of powder or 27 lbs. of Emmensite; the armor-piercing shell is similar to this, but is cored to carry 38 lbs. of Emmensite.

The increased weight of this second-class shell is intended to compensate for the diminished height of fall at short ranges.

A third pattern, known as torpedo shells, will be provided; these are to be 5 feet long and will carry 100 lbs. of high explosive.

All shells will be filled before being stored, to do away with the handling of explosives—the only work will then be to replace the plug with the base percussion fuse; there is but little danger in handling the fuse shell, as the shell may be dropped on concrete from a height of 25 feet with safety.

The shell will be supplied with the ratio of 60 per cent. of the 800 lbs., 30 per cent. of the 1000 lbs. and 10 per cent. of the torpedo variety.

The torpedo shell will be stored in the recesses next to the magazine; the others will be stored in the long galley four tiers high, the points to the wall so that the fuses can be placed in them; this system of storage reduced the available width of the passage to three feet, when the contemplated supply of ammunition is in place.

Solid shot will also be supplied for finding and verifying ranges; they are to be piled in the approaches to the battery.

The powder is to be handled on overhead trolleys and taken from the end of the central passage, where the delivery is made to the piece by the Gordon truck; this is a four-wheeled carriage, moved by two handles; the projectile lies horizontally on a tray at the level of the bottom of the bore of the mortar in the

loading position; the cartridge rests on a side tray at the same level; the truck covers a floor space of 5 feet 6 inches, by 3 feet in height, with shell in place 5 feet; its use does away with the shell hoisting apparatus now on the mortar.

The firing arrangements are designed for discharging the pieces by groups, in succession, with intervals of, say, four seconds, to lighten the shock.

The defense of the battery against landing parties contemplates infantry parapets, and perhaps machine-gun emplacements would be thrown up on the central mound, at the outbreak of the war, preferably by sand-bags; but shallow trenches need not materially weaken the cover of the magazines and galleries against heavy projectiles from sea; this and the ditch, where there is one, would permit an obstinate defense by the Regular artillery garrison, even unaided by infantry, against the sailors landed to destroy the battery.

The battery will not be exempt from attack by vertical fire, as the last number of the Journal, Naval Information series, states that the design for a first-class cruiser includes 12-inch rifled howitzers, having a length of thirteen calibres and intended to fire shell filled with Liddite, an English explosive.

The maximum offensive power of the mortar battery will then be, for one discharge, 1600 lbs. of explosives, at an extreme range of say 12,000 yards, with 16 chances of a hit.

SERVICE.

The successful service of the mortar battery depends upon the accurate performance, within a given time, of so many essential duties, that thorough training and constant exercise are as much, if not more necessary, than in probably any other artillery duty.

As the successful service of the individual piece is the foundation of the efficient service of the battery, its manual should be a simple statement of the most rational and natural way of rendering, as nearly as possible simultaneously, the different services of cleaning, loading and aiming. The ideal to be sought for is that the loading should be done so quickly that it will be completed before the aiming, which should be recommenced as soon as the gun runs "in battery" from the recoil,

on a gravity recoil carriage, or when the mortar is returned to its position by the springs. This ideal is attained in all rapid-fire guns, including the 6-inch ; with the mortars it is of course impracticable at present, but the nearest approximation should always be sought.

The time for loading the mortars should be reduced to a well-established minimum so that it can be counted on as a constant quantity ; to accomplish this, "in any exercise the piece should be actually loaded, and the loading carried to its extreme—the firing of the primer; not to do so, is to give a false idea of what may be expected in action as to time and exactness in loading. Going through the motions should be permitted only for the beginning of the recruit instruction."

At Sandy Hook, using the Gordon truck, the steel mortar in a test for rapidity, was loaded with the 800-lb. projectile and fired ten times in 21 minutes and 7 seconds. This indicated that aimed volleys could be fired at five-minute intervals, twice as fast as General Abbott calculated when he computed the probability of hitting a vessel the size of the *Inflexible*.

An examination of the proposed method of firing the battery with a horizontal position-finding system, will show how inter-dependent the services rendered by different parties are, and how necessary it is that they should be in the habit of working together.

Suppose the magazines opened and lighted, the gun, magazine, plotting, firing and observing detachments at their respective stations and ready, and the battery commander stationed at the firing station, which is necessarily located so that he can see the target and the fall of the shot.

Having selected his target, satisfied himself that the observers clearly understand which vessel it is, and having notified them that the observations will be called for, say at one minute intervals, he directs the time-keeper to signal for the first observation.

The first signal is given, the angles received and the position of the vessel plotted.

At the second signal, the second position being plotted, shows the vessel to have moved, say 2.1 inches (speed 7 miles per hour) and also the direction in which she is moving.

Now, if the vessel in one minute travels 2.1 inches on a chart which is drawn to a scale of 100 yards to one inch, then in five minutes, granting that it takes that time for the battery to be prepared for firing and the shot to reach the target, a point 10½ inches from the last and in a line drawn through the last two plattings will give the position to be predicted, the number of the square she probably will be in, then the charge, angle of elevation, and azimuth angle are taken from the table and with instruction as to the kind of projectile to be used and the command "load" are sent to the battery.

The angles of a point short of the predicted point, by an equal amount in space to the time required for a signal to be received from the observers, plus the time of flight of the projectile, are sent to the observers, who continue their observations until the enemy reaches a point within one interval of the designated angles; the instruments are then put at those angles and the instant the bow of the target intersects the vertical hair, the signal (the tap of a bell) is sent, the regular interval angles are then resumed until the splash of the shot occurs, when its angles are taken and then sent in.

In the meantime, at the firing station, word has been received that the battery is ready, the plotting shows no material change of direction by the target, so on receipt of the signal from the observers, the sighting shot is fired, and, if the prediction has been successful it may be followed by the fire of the whole battery, because, taking the extreme range, the target will have changed its position only from 30 to 50 yards, which leaves it still well within the area of fall of the projectiles which, as shown by the firing of the whole battery at Sandy Hook, covered an area at 6000 yards range of about 240 yards long by 137 yards wide; at 3000 yards range all the shots were contained in a rectangle 82 yards long by 115 wide. If depression range-finders are used, then the work of the observers, making the prediction and allowances, are all done at the instrument.

Now let us see what was done at the battery when the order was received for, say, "Charge 105 lbs., projectile 800 lbs., Elevation —°, Azimuth —°, Load." Received in the room at the end of the central passage, the order had to be sent to the two magazines and the four pits,—by speaking-tube, messenger,

telephone, or pointing telegraph, yet to be determined. We will take one magazine and two pits as an example. The non-commissioned officer in charge of the magazine receives the order and directs his men to put eight 105-lb. cylinders on the trolleys and take them to the end of the central passage, the delivery place designated.

Arrived there they find the end of the way occupied by two parties of two men, each hoisting the projectiles with differential pulleys to deliver them to the trucks which stand one foot above the highest tier of projectiles; there are eight projectiles to be put on as many trucks at this point, and each truck is also to receive one of the eight 105-lb. cartridges; certainly there is need of training here to prevent confusion, and permit supply in the minimum time. As Nos. 9 and 10 will be with each truck and only one truck can be used with each piece, Nos. 11 and 12 may be dropped from the provisional manual now in use. When the pieces are all loaded and the wires connected, the fact is communicated to the telephone room and from there to the firing station; eventually it is presumed that this will be done by simply inserting a plug in a switch-board, which will signal "ready" to the observer at the position finder.

After the mortars are fired they can be cleaned while the next order is being received and the ammunition brought up.

As the predicting officer must see the plotting board, the target and the fall of the shot, it seems preferable to send the order for the charge, kind of projectile, and the angles from the firing station to the battery, than to send simply the number of the square and have each pit commander take the same information from their tables; the latter would increase the number of tables by three, and in any event the battery commander would have to designate the kind of projectile to be used and make the corrections on the fall of the shot.

The foregoing sketch will give an idea of the number of details to be coördinated for the best service of the battery, and show how essential it is that the peace training shall simulate as nearly as possible the conditions of war. In fact, it is only by constant practice and repetition that the predicting officer can become and keep sufficiently expert to feel that confidence necessary to success.

Reprints and Translations.

"THE PROBLEM OF THE ATTACK."

By Major E. S. May, Royal Horse Artillery.

(*Aldershot Military Society Papers.*)

IF to-day I approach a well-worn theme which has been written about and spoken of unceasingly since the war of 1870, it is because a doubt as to how to attack a foe in position seems still lurking everywhere, and that opinion, with no recent great war to solidify it, is still largely in a state of flux. During the last few months discussion has been more than usually active. In France General le Joindre has just written a book dealing with battle formations and fire tactics, "Tir de combat individuel et collectif." In Germany the third part of General von Verdy's "Studien über den Krieg" has appeared; while General von der Goltz's writings show a feeling of uncertainty as to what the latest developments in armament may lead. In our own country we have had Colonel Hime's most carefully thought-out and valuable paper on "Infantry fire formations," while last, but not least, we have all read with interest the little pamphlet on "Preparatory battle formations" by Major-General Bengough. The few works I have named, out of many, are but examples of an astonishing activity of thought, which is even more strongly evidenced in the articles and letters that flood our military magazines and papers. Yet no one will admit that the last word has yet been said. It is not in fact possible to attain finality, nor desirable that we should do so, because the conditions of the problem keep varying as armaments are improved, and the circumstances of the moment must in any case have an altogether predominant voice before anything in the nature of a scheme is formed.

But if in abstract discussions certain signs of doubt and uncertainty are visible, nothing of the sort appears when modern tactics are exhibited in concrete form at manœuvres. The facts in the problem of the attack may be represented by indeterminate quantities, or they may be allotted values which we may regard as arbitrary, but we can be sure that in the end they will all be made to work out the same answer, namely—success. Success, victory, triumph, achieved finally perhaps with the circumstantial pomp of former years, is a dominating characteristic of deliberate attacks both at German and French sham-fights, until occasionally to attack seems to have become synonymous with to win.

Indeed I think the general who ventures to adopt a defensive rôle is

made to appear a little unfashionable, lacking style and dash, and somewhat of a slow coach.

We see some light sparring at first, the artilleries engage, and fate seems for a brief period to swing perhaps in the balance; but very soon the tiresome delay is over, if the guns opposite are not silent they ought to be, and then we often find the tide of advance flowing forward irresistibly, until pent up and accumulated in the main fire position it inundates the defense in one culminating wave of destruction.

"Redan Windham" used once to say that there was nothing so unlike a real battle as a sham one. I believe every one feels to-day that in spite of many salutary changes and vast improvements during recent years, his sarcasm is still as true as ever. We cannot reproduce the slow development of a battle, because there are many considerations, besides a desire to introduce realism into manœuvres, which govern us, especially in this country, where however the situations often seem to me less unreal than they are elsewhere. To bring a field day to an end within reasonable time, progress must often be prematurely developed, and if the general onlooker is astonished occasionally by what he sees take place, he does not know that subsequent criticism places the situation in its true light. But whatever the subsequent decision of umpires may be, the tendency of what we see being done in all countries is to give a general impression in favor of the tactical offensive, and speaking under the shadow of the great leader who so repeatedly demonstrated the advantage of a different attitude, I think I may appropriately dwell on the difficulties which are often left out of sight or ignored.

Those difficulties are in truth so great that many soldiers are realizing that our present-day tactics are still merely in a state of transition, that infantry are drawing nearer to artillery while cavalry are still indispensable to both. It is because infantry, endowed with long range fire, may perhaps endeavor to do at one stage what they had best leave to the guns, and that at another the guns may strive to intervene where they had better leave room for more rifles, that I have ventured to address you on this subject to-night. And in discussing the action of infantry I wish to say that I am endeavoring to place before you continental ideas as well as those of our own countrymen, and in doing so I am rather seeking for the views of some amongst my audience than obtruding upon it the opinion of a very humble individual who belongs to another arm of the service. We will commence by assuming that the advanced guard has succeeded in learning something as to the force before it, that a careful reconnaissance of the hostile position has been made and that too by the officer in supreme command. I cannot avoid thinking that sometimes we see amongst ourselves a tendency on the part of such an officer to keep somewhat too far to the rear. I believe he must go ahead and see for himself in modern war just as was the custom of the great leaders of the past. Napoleon invariably placed himself as far to the front as he possibly could before he made his dispositions; his

ideas on this subject are very clearly and decisively expressed in his letters to his brother Joseph, amongst those lately published by Baron Thiébault. Some of you will remember how mercilessly he there upbraids his brother: "You should have bivouacked with the skirmishers of your advanced guard; that is how I made war," and so on to the same effect in language most unbrotherly and arrogant. It will be more than ever difficult in these days of long ranges and distances to subsequently correct dispositions originally faulty, and therefore I do not think the necessity for a very careful and thorough reconnaissance can be too strongly insisted on. But there is a special reason for it as regards artillery; guns are now-a-days pushed on far ahead of the main bodies, and I believe there is a distinct danger with regard to that in several respects. Firstly, the batteries may be too eager, and may prematurely enter on a struggle with superior forces in which they may be so mauled that they will not subsequently be able to adequately cover the attack of their infantry which is so slowly plodding forward far behind. We have an example of such an error in the over rash manner in which the batteries of the IX. Corps were handled at Gravelotte, and we know that the loss they then sustained was not commensurate with the effect on the general course of the battle which they produced. Secondly, a battle may be brought about which was not intended to be fought, as was the case at Wörth, when the sound of cannon precipitated matters in a manner against the wishes of the Crown Prince. Thirdly, the deployment of a long line of guns without strong support may give an opening to an enterprising hostile cavalry, which it may turn to excellent account. For all these reasons a general should endeavor to control the action of his guns as long as possible; should make it subordinate to the comprehensive scheme he has in view; should see if possible for himself, and not relegate the handling of so important a weapon to a subordinate, however capable.

But now I will precipitate matters myself, and suppose that the cavalry and horse artillery have drawn off to the flanks, and we will hope that these two arms will be left there together to utilize their opportunities under the eye of the cavalry commander, who must now be given a more or less free hand.

It will also be necessary, if we are to thoroughly probe the problem we are dealing with, to assume fairly open ground and a frontal attack.

It is an easy way out of the difficulty to say that you will take advantage of cover. When advancing you would no doubt turn all advantages the ground may offer to the best possible account, but it is to be anticipated that your opponent will have chosen his line of defense, so as to present as little favorable a terrain for you as possible, and you have no right to count beforehand on it greatly aiding you.

We will also put the chances of a flank attack for the moment out of sight. With small bodies of troops manœuvring with that object in view before an enemy is a far simpler matter than where army corps are

engaged; the bodies must often then converge on one another from distant starting points, and the strategic element asserts itself. At Königgrätz and Sedan the meeting of great masses on the battle-field was successfully carried through, but we may have to wait long for another Moltke and another Königgrätz, and in hands less capable than his such combinations may end less triumphantly than they did under him. Besides, every attack on a large scale must ultimately develop into a frontal one because the reserves of the defense will turn to face it and will have time to do so owing to the large arc on which the turning movement must be made.

The attack having been decided upon, the artillery will become engaged, and while it is struggling with the opposing guns there will be ample time for a careful organization of the infantry advance.

It may again be remarked that, while no rigid and pedantic adherence to the original orders need be insisted upon, forethought must now be largely exercised, even as far down in the hierarchy of command as battalion leaders. It appears quite certain that the galloping about of staff officers, adjutants, and messengers will not be possible in a modern battle, that there can and ought to be little of personal command on the part of seniors, and that it is therefore most essential that orders and instructions should be carefully thought out and composed at the outset. The absence of interference and personal direction on the part of the higher leaders is the characteristic of foreign manœuvres which has perhaps most impressed visitors from this country, and is worthy of our imitation. The allotment of objectives, the division of frontage down to individual battalions, the precise distribution of the several lines, and such other broad outlines of the scheme can all now be dealt with. Further, there must be impressed on every one that once launched the attack is to be carried through. Amongst all nations there is unanimity that this must be the guiding spirit, there must be no misgiving, no open instructions, no room for independent action here. Without a doubt the next war will be full of surprises, but they must be met as circumstances offer opportunity, and the sternest resolution and most unflinching determination must be concentrated in enforcing the one iron rule "go on" from the moment when the first skirmisher now starts on the enterprise before him.

The exact distance at which the deployment is made and the precise nature of it must be left to circumstances. But I may say that you will usually have to get into fighting formation when you come within about 1800 yards of the enemy's position. The screen of skirmishers or battle patrols, or whatever you may call them, in front will feel the way and help you to decide.

The problem which at this moment is puzzling many heads now first presents itself. There is only one way in which even the very bravest troops can hope now-a-days to beat their enemy, and that is by attaining a marked superiority of fire. That again can only be accomplished

by what we may call mechanical means, the weight of artillery fire in the first place, the precision and intensity of rifle fire being added to it somewhat later.

Moreover before infantry can hope to effect any decisive result they must get within 500 or 600 yards of their goal, and superiority of fire is after all governed by the number of rifles in line.

To turn an enemy out of a position you must therefore at the culminating moment be in superior force. Yet there is a long and perilous path, a mile long perhaps, in front of you before you can gain the vantage ground which you intend to make your main fire position, and you will almost certainly be losing men all the time you traverse it. Even should you be in great superiority when you start, will you still be so when you arrive at your destination?

The books make it quite a simple matter, they all say, the artillery having subdued the hostile artillery, the infantry go forward, or words to that effect. But it would add an element of realism to manœuvres, and I am sure would make us all think what this artillery combat really means, if a delay were made occasionally now, and a general informed as to what he might expect from his artillery, whether it was a preponderating power or the reverse, and if he were asked to modify his dispositions in accordance with the information given him in the same way as is done at a war game.

Supposing that it became apparent that his batteries were not superior to those on the other side, would he still go forward, and if so how? Or would he attempt to draw off? I do not think it would be usually anything but extremely hazardous to attempt the latter, unless he can find a defensive position to take up comparatively close in rear, and he will therefore often have to press on in spite of the fire which the guns are sure to turn on him.

But as a basis for argument here we may assume that the result of the artillery duel has not been very decisive one way or the other, and that, though your batteries may have been found inferior in power to those of the defense, they are still able to coöperate with the infantry. Even in spite of an avowed inferiority in artillery it will be best usually for the infantry to continue their onward march. If the attack is held back the guns of the defense will have nothing to distract their attention from your batteries, and in a prolonged artillery duel pure and simple the latter must eventually become silenced. To avoid that contingency, and to draw the hostile shells partly at any rate away from the guns, it will be better to send the infantry on, and then under the lessened strain your batteries may be able to refit and collect their shaken energies to throw themselves once more into the scale at the decisive moments later on.

I believe that during this advance the infantry should keep on forging steadily ahead, and in spite of losses should abstain from firing, leaving fire entirely to the guns of their own side. You must halt and

aim deliberately, perhaps lie down, to hope for much effect at such ranges as I have in mind; while in extended formation fire discipline is difficult. You must enter on a fire fight now at a disadvantage, and unless you know the range accurately you will probably not make many hits, for the presumption is that the enemy's infantry supports and reserves are under cover, and you can only have a good chance of hitting men in his shooting line. Meanwhile he has several lines behind your foremost one to catch any wild bullets.

The guns may offer a better target, and we know what "Infantry Drill" says with regard to them; but in this connection I must add a word, nevertheless, which will place your difficulty there clearly before you.

A gun detachment consists of nine men, four of these are actually working the gun, two are behind a wagon or limber setting fuses, and are to some extent covered by the ammunition boxes, the remaining three are lying down in reserve under cover. A battery does not feel the effect of loss at all therefore until three men per gun in the firing line have been disabled, or, in other words, its powers will be in full play until the guns have incurred a loss of 50 per cent. But one man can set fuses and supply ammunition without any sensible diminution of effect, and the loss therefore of even another man per gun would not produce much result. The guns are practically none the worse for being shot at even by artillery; they have no nerves; and are less affected by the personal element than any other arm. You will understand therefore that you can scarcely hope, while moving forward, to subdue hostile artillery by fire at ranges other than those that are at any rate medium. It will pay better I believe to think only of utilizing cover and pushing on, and leave firing, except under special circumstances, severely alone.

There are some authorities on the continent, men who attach immense importance to the enhanced properties of both guns and rifles. To such the attempt on the part of infantry to advance usually without firing almost up to decisive range will seem like a return to purely shock tactics. The answer to such is that if the men are allowed to halt and fire standing up they will present a most vulnerable target to their enemies, and we may be sure that the accuracy of their fire will be very small. On the other hand if they are allowed to lie down and endeavor to aim with nicety it may be difficult to make them go on again. Therefore, while infantry is supported by artillery fire, its chief endeavor should be to push in if possible to somewhere near decisive range.

There remains the objection that it is extremely difficult to prevent men from returning fire, and that it encourages them if they are allowed to do so. If the Old Guard could be trained to advance with ported arms in the teeth of case from artillery, and musketry, which at the very short ranges involved were as deadly as anything which we can imagine, modern soldiers can be taught to do the same.

No losses incurred in recent war are as heavy as what were endured without flinching even in the time of Frederick the Great.

During the attack of the Grey Knoll at Sohr, the Grenadier battalion Wedel lost 10 officers and 301 men out of a total strength of 12 officers and 390 men. In the assault at Kesselsdorf the Grenadier battalion Münchow lost 5 officers and 371 men, or 80 per cent. of its strength. At Zorndorf from one-half to one-third of the forces engaged were killed or wounded; and yet Frederick taught his men to advance at a deliberate pace without returning a shot until they were within perhaps 50 yards of their opponents, while we know that it was his ideal that no fire whatever should be delivered until that foe had turned to fly.

But there is this considerable difference in the circumstances of then and now, that whereas formerly the frightful slaughter did not occur until the last moment of the assault, and only lasted for a comparatively brief period, when the men locked tightly together in several ranks had scarcely time to notice them, and were bound together by an iron discipline which held them perhaps in greater dread than did death itself; modern losses must be endured for longer periods and in formations where personal influence and authority are unable to reach individuals.

And moreover, while formerly the fear of death had to be overcome in order to enable a man to close in personal combat with his foe, discipline has now to exert all its resources to carry him to a place where he can effectively shoot at but is still a long way from closing with, his enemy. Until that vantage ground has been gained, and you have by fire power borne down his courage and resolution, you cannot hope for victory. A line of rifles wielded by men of cool fortitude is impregnable. That was proved many a time in 1866 and 1870. But we need not go to foreigners for examples, our own experiences in the last few years have sufficiently taught us that this is so, and fanaticism, great numerical superiority, and courage altogether indifferent to death, have, in their last stride it may be, but certainly and inevitably none the less, yielded to the stern logic of a flat trajectory.

If any one can be found to still doubt that, let him note how the two nations, who have had most experience, both insist on the power of fire with an emphasis which is unmistakably evidenced not only in their regulations but in the example they give us at manœuvres.

Those who have seen the great rows of guns wedged in between the thick shooting lines of infantry, the utter disregard occasionally shown to all the precepts of the drill book in order to get them there, the complete indifference as to the exposure of men and horses in the final phases of the fight, those, I say, who have seen all this must realize that it has only one meaning for us. We may think such tactics unreal, theatrical, impossible, but they are the deliberate outcome of vast experience of unexampled study of military science, and they tell us this, that you must accept all risk and all loss when you mean to drive an attack home, and that every yard of front must be made to carry as many shooting machines, be they guns or rifles, as can possibly be got there.

We know that, if you reduce the normal intervals between guns by

half, you may expect to see your losses increased fourfold. It is certain that the teams of artillery must suffer terribly if exposed to fire at decisive ranges, and, as I will explain, it is not always desirable or possible to fire over the heads of troops in front of you. But one and all these considerations are habitually thrown to the winds when at foreign manœuvres superiority of fire is demanded at the decisive point, or in other words, when to break into the enemy's line at all costs is the determination of the leader.

In comparing the tactics of the past and the present we must further remember that the necessity for studying economy in life should be more present to the mind of a modern general than to his predecessors, because the effect of rifle fire has become directly proportional to the number of rifles that can be placed in line. Formerly the development of fire governed formations, and all through the history of fire-arms we find so close a relationship between the rate at which the infantry soldier's weapon could fire and the formation in which he stood that it can be reduced to a mathematical formula, as has indeed been just lately done by Colonel Hime.

In the 16th and 17th centuries infantry were drawn up ten deep. Why? because it took so long to load the fire-arms of the period that to keep up a continuous fire it was necessary for the first rank to fire, file away round the flanks and load, while the second rank did the same thing. Each rank in turn performed the same evolution, and finally the original front rank was again in its proper place, and ready to fire when the 9th had cleared its front.

Improvements in fire-arms had reduced the number of ranks in the time of Gustavus Adolphus to six. At the beginning of the 18th century four only were needed, and successive improvements enabled Frederick to use but three. The third rank was never worth anything except to support by its presence the other two, and in 1808 Wellington broke through all received traditions, and the regulations of the Horse Guards, which tried to hamper him, and, when he got his head in the Peninsula, fought in two ranks only.

It is due to his clear-headedness, his confidence in the courage of the British soldier, that this formation, which gave us an immense superiority in fire, enabled us to beat the French in the Peninsula, and the Russians at the Alma.

But whereas then formations were studied to develop fire, not to minimize losses, of late, when all nations have been obliged to fight in lines of single men in order to get the most out of their weapons, are all pretty much on an equality, the problem as to formations still survives with reference as to how the effects of hostile fire may be most reduced.

An injudicious formation does not as of old directly reduce your fire effect, but it does so none the less in a different way, because it may cause you such heavy losses that the number of your rifles subsequently available in the shooting line will be diminished.

We find therefore in all countries various theories and schemes put forward, all intended to facilitate the traversing of the wide zone swept by the guns and rifles of the defense.

And turning again to military history it is very noticeable how the experience reaped, perhaps at a heavy cost at the outset of a campaign, has taught men to modify their formation, and attain equal success at a diminished expenditure.

At St. Privât the German Guard Corps lost 307 officers, 7923 men, and 420 horses, and at Sédan only 25 officers, 424 men, and 190 horses, and yet had certainly no smaller share in the success of the latter battle than it had in that of the former. Similarly the III. Army Corps of the Germans in the battle of Vionville lost 310 officers, 6641 men, and 677 horses, while the whole army of Prince Frederick Charles, in which it formed one out of four corps, lost between the 4th and 31st of January, 1871, during almost daily actions, including the three days' battle of Le Mans, 229 officers, 3721 men, and 426 horses, or about half the loss one corps alone incurred on the 16th of the previous August.

Such statistics might be added almost indefinitely to prove, what will nowhere be contested, that faulty formations at the commencement of a campaign have frequently led to slaughter which it was quite possible to avoid.

To discuss here the question as to what formations are the least vulnerable would lead me far from my object, and I own that I think that until we have had more experience it is a somewhat futile one. I may say, nevertheless, that it seems more essential to keep men under control than to avoid loss, while it is more easy to derive benefit from the undulations of the ground in small flexible columns than in line or rank entire. Such formations as those recently put in practice at Aldershot manœuvres by Major-General Bengough, namely, small columns, composed preferably of sections moving by "fours" at extended order interval, appear well adapted to combine elasticity of movement with complete control, while they retain the power of forming rapidly to the front, and opening fire in single or double rank. They also render formation to a flank to meet cavalry easy, and facilitate too a change of direction in the advance. Whether or not they are less vulnerable to artillery fire than an extended line is a question which will best be decided by experiment and experience on active service, and until we have had, as I believe we are to have, the former, it would be rash to pronounce a definite opinion, but I am sure that a line is certainly easy to range upon, although the effect of one well burst shell would not be so disastrous as if it burst in front of even a light column such as is suggested. But as General Bengough himself admits it must be distinctly understood that the same formation will not be applicable to the whole field, nor to all the circumstances that may occur. We must leave the matter of formations to the captains, and it is in regard to these that the lower officers will find most scope for the exercise of ingenuity and

discretion. It would appear judicious, however, to make the supports overlap the flanks of the skirmishing line, and for this reason: The depth of effect of both artillery and infantry fire is such that bullets passing over one line are very likely to hit another in rear, while again there is a distinct tendency for men to aim rather for the centre of the opponents' line than for its flanks. There is also less danger of being hit by projectiles which have missed the first line if you are behind its flanks than behind its centre. It is, further, better to have the supports behind the flanks furthest from the guns, should the artillery be on one flank of the attack, because the batteries should safeguard the flank nearest to them while the other will often be *en l'air*, and also because the further flank will be more secure from the effect of shells fired at the guns.

To revert to the matter of fire—Napoleon said, "l'arme à feu est tout; le reste est peu de chose," and if his words were true at the beginning of the century they are ten times more so at its close. The arms then that must decide the issue of the day are those which act by fire, and especially must the action of artillery, the arm which has no power except through fire, be favored.

Guns can do nothing unless left for some period in a state of rest, the infantry on the other hand must ever hold before it the idea of movement. It only halts to recuperate for another advance, its goal is the interior of the enemy's position, and it cannot gain the victory until its presence there has driven out the defenders. Clearly then it should be the object of the artillery to secure unbroken progress for their comrades' advance, and their endeavor on the other hand should be so to move that the batteries may remain at rest to carry through their duties. The two arms are working together with a common end in view, they must coöperate so that neither may interfere with the other.

It is time then to look into this matter of coöperation and to add a word with regard to it.

Much of what I have to say may seem mere truism, platitudes that are obvious to everybody, and are unnecessary to touch upon; yet in war it is simplicity which is valuable and simplicity is difficult. If I dwell on the need for both arms fully understanding one another, and sometimes may seem to desire the infantry to conform to rather than influence the action of artillery, it must be borne in mind that the destructive effect of artillery has curtailed the freedom of movement which batteries formerly possessed, while their increased mobility and greater range will cause the main body of the infantry to find them already in position before they arrive on the scene. The guns therefore must at first form the framework of the line of battle whatever their subsequent employment may be. If their range is to be fully utilized they must be brought up into position before the infantry, to which they are attached, arrives. We also know that their effect is much enhanced if employed in masses, which may concentrate their fire on certain definite parts of the hostile line. These are the reasons why it has become necessary to

work them all as much as possible under one hand, and why divisional generals sometimes complain that they are bereft of their batteries. If any other rule prevailed, when several divisions formed an army, the action of the guns would lack combination, positions would be seized and occupied without reference to the interests of the whole force engaged, and the ground available for guns would not be parcelled out with the great advantage or with the economy that is so essential.

I need not also add that it is a very undesirable thing to alter positions which batteries have already taken up. When once they have become, what may be termed, stable, in five or six minutes they will often have found the range, and will be settling down to a deliberate cannonade. If they are ordered to move, their horses will have to be brought up into the fire, there will be considerable risk of loss amongst them, while, when the new position is reached, the whole process of getting into action and ranging will have to be begun over again.

Occasions may arise however when it may become necessary for them and some of the troops near them to change front, and then it is important that the infantry should avoid getting behind them or they may be struck by shells intended for the batteries.

For the same reason it is very essential that the reserves of the attack should avoid assembling behind a line of guns. A spur or crest line will often form the artillery position and may afford tempting shelter to a brigade still in compact formation.

I remember in 1893 at the Swindon manœuvres seeing a brigade thus massed directly behind and not more than 200 yards from a brigade division in action. The General Officer in command of it was ordered to move it at once, and was naturally eager to do so the moment he realized the risk he ran. Every shrapnel which burst over the batteries would have made havoc amongst the masses below; in war the first shell or two would no doubt have caused that brigade to leave the spot, but even one shell would bring heavy loss in ranks so closely placed together, and the error would perhaps have cost many lives and produced a very bad moral effect before the men were engaged at all. I firmly believe that just the same mistakes and just the same procedure we see at all manœuvres will at first be visible when we find ourselves at war in earnest, and therefore I have called attention to a matter which some will perhaps think hardly worthy of a reference.

If however it is unwise to get behind artillery it is, in the earlier stages of a fight, equally so to get in front of it. Foreigners think nothing of firing over the heads of their own troops, and often place their batteries in two tiers, and no doubt we must sometimes do both, especially later on in the battle. For all that I should much prefer not to fire over my friends' heads just as I know they will dislike the process, but more particularly would I dislike to do so during ranging, and for this reason.

We have only one projectile now, the shrapnel. In order to cause it

to travel safely in a limber box it is provided with two safety pins. If you fire it with both in, it will travel and act like a solid shot; if you pull out both pins it will burst in the air at the point you set it for, or failing that it will do so when it strikes the ground. If you only pull out the percussion pin it will not burst until graze. I should further add that all fuses are carried set to burst at 500 yards from the muzzle.

Now consider the situation.

A battery when finding the range only wishes the shells to burst on striking the ground, therefore the man loading only pulls out one pin, the percussion one. But supposing him to become flurried and pull out the time pin in error, or that the jar of discharge breaks the pin, then the shell will burst in the air about 500 yards from the muzzle and the ground will be swept by a shower of bullets up to 1000 yards from the gun. On the other hand infantry lying down within 600 yards of a battery may be endangered by a shell bursting prematurely in the bore and acting like a round of case.

I do not say either of these dangers is a very imminent one, nevertheless there they are, and I have seen both the mishaps, and especially the former, I dwell upon, occur at practice to an extent that teaches me that they should not be ignored.

The worst possible effect on infantry is produced by even slight damage inflicted in the manner I have indicated; we have that on the authority of foreign officers who have witnessed it, and on that of officers in our own service too. I heard Sir Redvers Buller say at Okehampton in 1893 that in the China War some of the lead coating that envelops the shells of our Armstrong guns fell amongst his men and that the effect was most disconcerting to them. The other day an officer, who had seen the same sort of thing happen a year or two ago in Burmah, told me he had found it impossible to get his men to go in front of guns; yet the German artillery had frequently to fire over their infantry in 1870, and Hoffbauer tells us that in all the battles round Metz instances of their doing so occurred.

When guns are finding the range however it does not seem necessary to go in front of them, and after ranging you will be quite safe 600 yards from their muzzles.

It will be well now to touch upon another point which is of extreme importance. We know from the story of how the Russian attacks at Plevna died down, that guns not carefully instructed may fritter their fire away on portions of the enemy's position not going to be seriously assaulted, and may leave the really decisive spot unshaken, or even not fired upon at all. The place where the breach is to be made by them should be communicated to batteries directly a decision is arrived at, and the strictest watch should be exercised that there is no misunderstanding on the subject. Here an attempt at realism is quite feasible at field days, and we should always make the most of it.

Again there is another way in which infantry and artillery on active service might aid one another, which we sometimes overlook in peace time. It is a small thing, a mere matter of form at manœuvres, but none the less ought we to practice it so that a habit, which will come as a matter of course to us in war, should grow up. There is no range-finder like a shell, and indeed I gather that infantry will now have none other to rely upon. Guns that have been some little time in action will usually have got the range pretty accurately, and when the lines of the attack pass them they should always inquire as to the range which is being fired at, and avail themselves of the information when they halt to fire. These two simple observances will at any rate aid in making the two arms appreciate their mutual interdependence, and will help towards linking them together.

And when the guns are given their objective the advance of the infantry should be directed so as not to mask their fire.

It is not to be expected that men advancing upon their enemy, and absorbed by what they see in their immediate front, will of their own accord pay much attention as to whether they may be in the line of fire of their guns or not. It therefore requires a great deal of skill and practice to keep the infantry advance in the right direction, while it is even more important that the batteries should concentrate their fire on the chosen part of the hostile position. We have the evidence of Prince Kraft, a man who saw much of modern war, to guide us here, and it is most explicit and distinct.

He tells us that it is a very difficult matter to make good later on an error in the original direction of a line of advance. Infantry move but slowly and the necessary corrections will entail a considerable waste of time, and probably a very regrettable loss of life.

At field days and manœuvres there is very little difficulty and the procedure is quite simple. When the firing lines threaten to come across the front of the guns the artillery commander can send a message to them to incline away from them. Certainly he can do so, and very often perhaps he does do so, at manœuvres. Even there however it is not always feasible to send away a really trustworthy and competent man, and an officer is not to be spared from his proper duty with his battery. But we have an interesting illustration from Prince Kraft as to what it is like to ride forward from the flank of an artillery mass in action to that of a firing line also engaged with the enemy, and must acknowledge that it cannot often be possible to do so.

He tells us he saw the feat accomplished once by (the then) Lieutenant von Roon in a reconnoitring action at Satrup on February 10, 1864, and that then "the hail of bullets which fell round him on the snow showed clearly how seldom such an effort could succeed."*

At the great fight at St. Privât we know that Prince Kraft was himself twice compelled to recall some skirmishers, who had pressed for-

* 14th Letter on Infantry.

ward prematurely, because they masked the fire of his batteries, and he describes his experiences as being so unpleasant that he was astonished to find himself coming back alive, while his horse was not equally fortunate. He goes on to say that it will as a rule be necessary to give up the idea of sending any orders to a firing line which is fired on itself by the enemy. It must be given its instructions before it is sent forward; subsequently the lessons of 1870 tell us that it can only be influenced by signals, and pushed forward by reinforcements reaching it from behind.

When we consider what the situation must be like in front of two forces engaged with one another in the last stages of an attack we must feel that his words are very weighty. How tremendous the storm of fire that beats the ground is likely to be we will appreciate from a little incident which happened at the battle of St. Privât which I have just referred to. When the Guard was engaged with the French riflemen a flock of sheep startled at the commotion galloped across its front. They were every one of them shot, and the Guard made a hearty dinner off them the following day. To ask men to rise and move to a flank under a fire such as is evidenced here is to demand too much from human nature. It would indeed be in all probability impossible to get your order obeyed, and if it were obeyed, half your men would be killed while making the movement.

On the other hand we may learn how disastrous it is for infantry to mask the fire of their artillery, and thus have to do without its help at the last moments of an attack, from numerous instances in military history, but especially so from the experiences of the XIth and Vth Corps of the Germans at the battle of Woerth. When the French right was assailed twelve batteries on the hill of Gunstett supported the attack of the XIth Corps. These silenced the French batteries opposed to them and then turned their energies to shaking the French infantry, a task which they also successfully accomplished; but when the Germans eventually reached, as they did, the crest line of the enemy's position they masked the fire of their guns, and were not adequately supported by troops in reserve. A counter-attack was made upon them by less than half their number of Frenchmen, and unsupported by guns and disorganized, as they were more or less by the efforts they had made, they were driven in confusion from the position they had just victoriously gained, and would in all probability have been swept across the Sauer but that in their retreat they again unmasked their guns, which turning their fire once more on the counter-attack brought it to a standstill. Very similar were the experiences of the Vth Corps, but in that case the batteries did try to go on to a second position, but were unable to find one.

I do not say that the masking of the guns in these cases was to be avoided, I only quote the illustrations as showing how necessary it is to avoid doing so, if possible, and of what may be lost if the two arms are unable to coöperate throughout with one another.

But I bring it forward for another reason too. The artillery in the first illustration I have quoted was to blame for not sending at any rate some batteries forward with the infantry. I believe it would have been difficult to find a position for them, or perhaps as the attack seemed to carry all before it, it was considered unnecessary to move, but at any rate we learn from the episode that in order to avoid becoming masked guns must often follow the progress of their comrades, and that their task is not ended even when they have crushed the hostile batteries, and shaken the infantry of the defense. A second position from which they may fight in the closest alliance with their infantry is necessary. The exact moment for their movement would, it seems to me, depend on whether the infantry had drawn most of the fire of the enemy upon themselves or not. Once this has occurred, if the artillery advance is well carried out as it will be by echelons, I do not believe the loss in horses will be so great as to bring it to disaster. It is not easy to get men who are excited to change their aim rapidly from one target to another, and if they do so quickly they do not adjust sights or aim accurately. But at whatever price, the guns must go on sooner or later, and must, if need be, at immense sacrifice get into action again if possible about 1200 yards, not nearer, but, for choice, not greatly more, from the hostile line.

Now to carry out this coöperation, the infantry at one time looking to the guns for fire and itself only thinking of pushing forward, endeavoring to aid the artillery by not getting in its way, and again the guns going ahead under the understanding that the fire from their comrades will draw off the attention of the enemy and facilitate their progress, all this demands an intimate association between the two arms, and a sympathetic feeling between them. Such close understanding is the fruit of much practice together and of a genial appreciation of the idiosyncrasies of either arm. Starting from the secure basis thus acquired the principles underlying the combined action of the two will always be recognized even when the exigencies of a field day or battle in earnest may compel men to alter methods to suit a particular situation, or break the letter of the law while acting up to its spirit.

It may be asked why I recommend guns to venture so close inside the effective range of modern rifles as I do. My reason is this. You cannot, I know, possibly improve on the destructive effect of shrapnel fire at a range of say 1500 yards. But very often, if you keep even at that comparatively short artillery range, it will not be easy to avoid that danger of which I have just spoken, the becoming to some extent masked by your own infantry. Moreover at 1500 yards or so you scarcely see so clearly where your shells are bursting and what effect they are producing, as you will at a somewhat shorter distance. At 1200 yards again you would usually be able to fire with confidence as regards the danger of not hitting your friends, and you may hope to keep up your fire on the point to be assaulted until the very last minute before

the rush is made. From that range in fact you might usually completely fulfil your mission, and I do not think that you would need again to press still further in. Not at any rate until the defense was visibly shaking and crumbling under your fire. The teams otherwise would, we can scarcely doubt, so suffer in the transit that the guns, or at any rate many of them, would not succeed in reaching the new position at all.

To take up two positions, one at some 2500 yards and the other at some 1200 yards, would be as much as we have a right to count upon the majority of our batteries being able to do, and, as regards mere hitting the target, we can do that with absolute certainty from the shorter range.

Moreover, much as both infantry and artillery may dislike it, towards the close of an engagement the latter may often be compelled to shoot over the heads of the former. Now, if the guns are at 1200 yards or so from the enemy's position, and the infantry is established in its main fire position some 500 yards from it, it is in no danger. Because it is far enough from the guns to be safe from the effect of a shell bursting prematurely at the muzzle or breaking up in the bore, and as the enemy's position will, we may feel sure, be on somewhat elevated ground, there will be no danger at such a short range of shells striking it that are intended for its opponents. Moreover it will be under the highest point of the trajectory of the projectile.

The guns need not cease firing the very moment the final rush takes place; on the contrary a very rapid discharge of all of them continuing for a fraction of a minute will give a culminating blow that may finally shatter the cohesion of the hostile line.

How important it is that the fire of guns should rather grow than diminish at the supreme moment of the day we know from military history. If their fire is suddenly stilled the defenders will suspect what is about to happen, will emerge from the cover behind which they have perhaps been crouching, and will ply their rifles with renewed energy.

It was thus that our battalions met the imposing advance of the French columns in the Peninsula and at Waterloo, it was thus that in spite of an immense preponderance of artillery against them the Turks beat the Russians back at Plevna.

Except on the ground of moral support I do not therefore recognize the advisablity of guns seeking to get within the zone of decisive rifle fire. But occasionally a weary and well-nigh worn out line of attack may need the powerful fillip and encouragement which the sound of guns in the midst of it will produce. That such moral support is a factor to be reckoned with no one can doubt. Some years ago were published the reminiscences of a Prussian artillery officer during the campaign of 1815. One passage, where he tells how his battery drove up into the firing line of the Prussians on our left at Waterloo, greatly

struck me. The infantry received the guns with a cheer and shouted with delight "here come our gallant 12-pounders!" The same warm welcome greeted them many a time during the war of 1870, and I will quote Prince Kraft once more where he says, "there is something very encouraging and comforting to the infantry, when at such critical moments they hear their own guns thundering close at hand. Only those who have heard the cheers with which at such moments the infantry receive the batteries can fully form an opinion as to the moral influence which artillery fire exercises on its own infantry." It is true, in that particular passage he is not advocating the presence of guns amidst the firing line, but many times in the campaign were the German guns thus placed, and you will always see them in the same position at both French and German manœuvres. Artillerymen must then clearly recognize that when the situation demands it they must be prepared to try and sustain their comrades, not only by their fire, but by their presence, hopeless as such an attempt may theoretically appear.

There remains, however, a stretch of ground, if we assume that the defenders have made the most of their chances, not less in all probability than a quarter of a mile, to be crossed before the goal is reached. How is that space to be got over? The second line will arrive having also probably suffered loss, and it will be weary too. Can you expect tired men to face a heavy fire over such a distance at a late hour of the day? The demand is a large one, and indeed it is not the slightest use to attempt the final rush until the defenders are visibly demoralized by fire, until they have ceased to show over the defenses, walls, buildings, or other cover which they hold. They must be cowering down to get away from shells and bullets, and have acknowledged their inferiority in fire before you attempt to seize their position. If that be not the case the assault will fail, but if all fire that can safely cover your final charge be brought to bear, it will not fail, and moreover, you will lose far fewer men in it than at any other period of the fight. That is the lesson which we may draw from the history of the past. Patience will bring victory, but if you assault before the enemy has been absolutely cowed by fire, he will again emerge from his cover, will meet you with renewed energies, and the attack, however bravely made, will collapse.

And how if it do collapse?

I have always thought that passage, in which the drill book, deviating for once into language almost picturesque, likens the main fire position to a parallel at a siege, a particularly happy one. A modern battle will probably often assume the character of such an operation; you must make a breach in the enemy's line by sheer destruction in the one case just as in the other, and then when the breach is declared practicable the storming party is launched. But in the siege the issue will be decided most probably in the early morning, in a great battle not till the evening. In both, in case of a reverse, the ground you have gained already must be held by your reserves, they must ward off the inevitable

counter-attack if your foe is equal to one, and you must try again, perhaps next day. If the French right had not been turned at Gravelotte, the battle would have been renewed again with daylight, from where it came to a standstill on the 18th. Battles, even before the breech-loader, often lasted more than one day. Aspern for example, and Ferozeshah, while Leipsig and Gettysburg continued for three.

And the possibility of night operations towards placing large masses of men under cover of darkness into position to make a fresh attack at dawn is recognized in the German regulations. Not only men but guns, because, if your assault fail, in nine cases out of ten it will be owing to your artillery having been beaten down, and being unable to adequately support it. In the night it may be possible to refit, replace, or add to batteries, and at dawn the work will have to be begun over again. This undoubtedly appears to me a direction in which night operations in the immediate presence of the enemy might in the future play a prominent part, and I refer to it, because in my opinion it will be as impossible to carry a well chosen hostile position without that superiority of fire, which is brought about chiefly by an overwhelming preponderance in artillery, as to capture a fortress or intrenched camp without a battering train.

It has been objected to the universally accepted scheme of tactics, which starts from the basis that the artillery has overpowered the opposing guns, that you cannot base principles on a main factor which is a matter of uncertainty. Germany and France have both very powerful artilleries, and which is the better we cannot know until the battle between them is over, but we in this country must look on the problem with less confidence than they, because, although we hope we may in a few years have them, we have not as many guns to start with as our neighbors, and have no adequate reserves behind. It is not in any case of merely academic interest to ask what would have to be done in a case where an attack had to be carried out without artillery, because a brigade or some such body might, in the course of a great action, find itself compelled to assault some particular locality where guns were not available to support it.

During the attack on Le Bourget on the 30th October, 1870, such an incident did occur when two battalions of the "Franz" regiment had to attack over 2000 paces of open ground without any assistance from guns.* The officer in command sent forward the whole of his first line, which consisted of two companies,† in thick swarms of skirmishers, and made them run in 300 paces at a time alternately by wings. After each rush the whole of the wing which made it threw itself down, and found cover amongst some high potatoes. There the men recovered breath while the other wing made its advance. The needle-gun, I need not remind you, had no aimed range beyond 600 yards, while the French

* Prince Kraft, 10th Letter on Infantry.

† That is to say German companies, each nominally about 250 strong.

Chassepôt was accurate up to 1500. No fire was opened until the leading wing got within effective range of its weapon from the village, but then the men began to shoot lying down. The whole scheme of the attack had been practiced and thought out beforehand by the officer commanding the "Franz" regiment, and the manner in which it was put in practice provoked the admiration of all the officers who witnessed it. It was thus carried on until the village itself was reached and the battalions in the advance to that point suffered no loss at all. In the subsequent struggle in the streets they lost very heavily indeed, but the manner in which half of the line of attack appeared and disappeared in the high potatoes, seems to have quite puzzled the French and disturbed their aim. Of course they were also very imperfectly trained soldiers, while the smoke of their rifles hung a great deal about them, and obscured the view. Still the example in view of the bloodless character of this long advance over open ground is full of interest and instruction, although we cannot in these days of smokeless powder build much hope upon it.

That is one way in which the aid of guns might be dispensed with, but speaking generally, if without artillery and unable to get near your opponent by surprise, or by a skilful use of cover, or by a flank or enveloping movement, there would be nothing for it but to try and develop fire effect analogous to that of the shrapnel, by putting a large number of rifles on what would have been the artillery position and supporting your attack by volley firing. The attempt we are discussing would of course be out of the question unless you had a vast numerical superiority, or the quality of your troops altogether surpassed that of your opponents. An immense expenditure of ammunition too would be required, and a distribution of fire in depth to reproduce the deep effect of shrapnel would have to be resorted to. When under cover of this long range rifle fire, the first line of the rest of the force had established itself within decisive range of the enemy, the reserves might again assume their proper rôle and seek their natural position.

I may mention here a suggestion which, as it is intended to benefit infantry engaged with artillery, as these reserves might be, appears not unworthy of attention and perhaps experiment. General le Joindre, who was formerly director of the French School of Musketry, and now commands one of their infantry brigades, in his little book, has produced calculations as to the power a French knapsack, packed according to regulation, possesses in resisting the passage through it of a shrapnel bullet. Since these calculations are based on the remaining velocities of French shrapnel bullets and the resisting power of a French knapsack, I need not enter on them here, but they carry with them the authority of Colonel Langlois, a well-known French artillerist, whose book, "L'Artillerie de campagne en liaison avec les autres armes," some of you will be familiar with, and according to them it seems that at 1500 yards no shrapnel bullet would be equal to the task when the shell burst

more than about 15 yards from the knapsack. The French knapsack is large and very easily taken off, as we all noticed at the French manœuvres last autumn, when every French soldier relieved himself of it during the shortest halt. Such an one placed upright would afford very considerable cover, and the idea appears to me full of suggestiveness. Of course we should need full experiments to guide us before a confident opinion could be formed; but if experiments showed the feasibility and value of the arrangement, an infantry soldier would possess a means of protecting himself against artillery fire which would always be ready to hand. The idea seems worthy of consideration, and I commend it to your notice, although it would involve a change in the manner in which our men now carry their packs.

So far in dwelling on the attack I have dismissed the cavalry and horse artillery with very little ceremony. But in a lecture which I had the privilege to deliver here last year I ventured to offer some opinions as to the action of those arms on the battle-field itself, and therefore I should be repeating myself did I dwell upon them again, even supposing that I could do so without making rather an extravagant demand on the patience and endurance of my audience.

If, however, I may be allowed a final word, I would like to add something with regard to which I have not said anything to-night. When the last word has been said as to ranges and artillery, and formations, and the difficulty of getting men across the last stretch of ground, the one factor which never alters, and which always has been, and always will be, the determining one in all warfare, the personal element, namely, remains to be reckoned with. Weapons and equipment, speaking within limits, do not win victories, these are the fruit of personal effort and exertion, and are chiefly brought about by the influences which raise the mind above the body. The highest form of self-denial, the loftiest subordination of his intesests, of his health, of his life, must be called for and exhibited by the soldier at the supreme moments when he forgets his individuality, and loses all other consciousness save the one ardent desire to go and win with his comrades.

Discipline is the lever we utilize to lift a man thus above himself, and discipline is more necessary in our day than perhaps it has been in any other. To produce the highest discipline some mightier aid, some more powerful incentive than mere fear of his superiors, or desire for a little more pay or promotion, is needed. All a man's better instincts must be appealed to, all the worthier motives which sway our human nature must be called out. The traditions of the service he belongs to, the deeds of the regiment he has joined, his pride in them, his regard for his comrades, his respect for his officers, these must supplement the austerer virtues of a sense of duty, and a wish to fulfill thoroughly the task he has been called upon to do. It is feelings such as these, engendering also as they do a sense of self-respect and emulation, which go to build up what we term *esprit de corps*, a motive power which in all ages com-

manders have taken pains to foster and utilize, but which civilians sometimes seem scarcely to understand. The Tenth Legion loved Cæsar, the sailors of the *Victory* wept for Nelson, the Old Guard died for Napoleon, because all these, and many another great leader too, looked after and cared for their men, identified themselves with their interests, and by bright example compelled respect and admiration from those they led. I believe in our regimental traditions, and above all, in our British officers we possess a weapon more potent than the newest invention of the most scientific gunmaker. Let us do all we can to cherish the tradition and privileges of our regiments, and when the crisis comes we may feel sure that our men will more than be equal to the occasion, animated by the associations in which they have been brought up, borne onward by a generous rivalry and emulation, by loyalty to their country, by hatred of injustice, and by love for their Queen.

DISCUSSION.

Major-General G. H. MARSHALL: There is only one point to which I wish to allude and that is in regard to Major May's remark about the suggestion of the Commandant of the French School of Musketry. We must not only consider the thickness of the knapsack to keep bullets out, but the length would have to be increased in order to give protection from shrapnel fire. I don't think it would be advisable that a large shield like that should be carried by the soldier.

Major-General W. O. BARNARD: It is a very interesting lecture and gives us food for much thought. There are many points of interest to which allusion has been made by Major May in the course of his paper, some of which have been mentioned in a memorandum recently issued for our instruction; this memorandum I feel sure will be of great value to us at Aldershot. There are three subjects I will refer to. 1st, there is the necessity for clear and definite orders being issued prior to the attack being launched—I feel confident from what I observed last year, and from what I heard, that a want of cohesion was frequently caused by brigadiers and commanders of battalions and companies not having received clear and definite orders previously. 2d, the necessity for keeping units in close formation as long as is consistent with safety. That has been referred to in the memorandum to which I have alluded; brigades and battalions are extended too quickly, and this also applies to smaller units. But really when you come to consider sections varying from six to twelve files with units so very small it appears doubtful, except when moving through woods, if it much matters whether the formation is fours or two ranks. 3d, the necessity that the second line in the assault should strike the first at the proper moment, and that these lines should advance at once. This is the most difficult thing in the attack as far as infantry is concerned, viz., how the second line shall strike the first, and how they shall simultaneously advance; the first must go on the moment the second comes up, any delay of the second line will be fatal to the first line; it is therefore essential that the second line should at the critical time be rightly placed and in the desired formation. It may be remembered that Colonel Hutton observed in his lecture on the German manœuvres that when the second line carried the first line forward it had the appearance to an onlooker of a series of isolated attacks; this proves the great difficulty to insure the simultaneous advance indicated in our Infantry Drill.

Major-General H. J. T. HILDYARD, C. B.: I will only make a few observations. Major May spoke of the state of flux in regard to the procedure in the attack of a position, and I understand he meant the attack of a position in force. Well, later on he rather showed us that it was not quite to be described in those terms. On most of the points on which he has spoken so ably continental nations have made up their minds; they fully recognize that it is of the highest importance that orders shall be clearly drafted and well understood, and unless time is given for this there will be mistakes and a possibility of what is in the mind of the commander not being carried out. Officers should give time and care in the framing of orders, and not be so anxious to start their troops without proper preparation. Then as to the proper forming up, troops arriving in column of route have to halt at some point preparatory to forming in battle order. Major May has indicated that perhaps 1800 yards is the distance at which they will be formed up; I think however we are agreed that we should get as near to the position as is practicable, having regard to cover, before getting into fighting formation, and to lay down any approximate distance at which this should be done is misleading. Then as regards artillery, the necessity for the concentration of this arm and for its preparing the way for infantry is acknowledged. The fact that the artillery will form the framework of the battle—that is in the case of an army corps or a division—is also recognized. Then we come to the question of the artillery preparation being completed; either the enemy's artillery will be beaten down or it will have held out against the attack. In the case of the enemy's artillery proving superior it has been suggested that the infantry of the attack will be launched so as to draw off some of the defender's artillery fire from its own artillery. I think in such an event if the commander of the attack makes up his mind to carry the attack through he will advance to this attack, not in a tentative way or with a view to getting relief for his artillery, but because he means to gain possession of the position notwithstanding the failure to subdue the enemy's artillery. Turning now to the procedure in the infantry attack, there is some diversity of opinion in regard to the distance from the defender's position at which firing should be commenced. But there is a very general agreement that the advance from this point to the main firing position must be by rushes. Having got to this firing position the development of fire has to be enhanced by every possible means so as to beat down the defender's fire preparatory to the assault. The assault follows, and it is in the procedure to be followed in the advance from the main firing position that the most marked diversity of opinion is to be noticed. It is a point on which I am sure commanding officers will have much to excercise their minds during the coming drill season. It may be possible to go forward without firing if the defenders are cowed; but it is not easy to cowe them in a good position properly prepared and defended. In the majority of cases then you may probably find the assault will have to take place without the defenders having always been thoroughly cowed. Then comes a difficulty; it is laid down in the drill book that the second line in its advance shall in such a case carry with it a portion of the first line, and shall go forward to the assault, firing as they go. We shall have to practice this to see how it is to be done; of course if you fire while in movement during the final advance up to the point of assault you must remember you will have two lines of troops mixed together, it will be at the most exciting and difficult period of the attack, and your men will be out of hand and of fire control. Though you may practice it and enforce order and fire discipline in

peace, this will hardly bear the strain in war. That is the main point we have to consider, and whether it will result in the general adoption of a system of firing while in movement, or of halting to fire kneeling or lying down, or whether it will result in trying to stop the firing altogether, will remain to be seen. At present the general tendency is in the direction of utilizing firing in some form.

Colonel J. TALBOT COKE, D. A. G.: I shall confine the few remarks I have to make to two points—the unreality of the operations in manœuvres, and the undue favor shown by umpires generally to the attack. I couple these two points advisedly, for I feel sure that the latter has much to do in producing the former. Greater realism can be given to field operations if a little more control is exercised in holding back the attack. We do not wish to stop the healthy initiative of our officers and troops, but we have umpires who really represent the bullets, and it is in their hands that we must really leave the matter of controlling the rate of the attack. Our attack is frequently left to rush on without establishing a superiority of fire, and we see the absurdity of a company trying to do the work which it would require a brigade to accomplish. Umpires should stop such impossible proceedings with a firm hand. We have of late years at Aldershot made great progress in our umpiring, but anyone who goes abroad and watches the conduct of the German and French manœuvres, comparing them with our own, cannot fail to see that our operations lack more than theirs do in reality. We are apt to be in too great a hurry, we require more patience in carrying operations through, and our "cease fire" is sounded too soon. Our umpires should remember that they give a commander no chance if they allow his attack to rush on at an improper rate, he has no time to bring up his second line, and operations which should cover one or two days are finished almost in as many hours. This of course is false training, and I believe if our umpires would exercise greater control we should have more realism and thoroughness in our operations and the work performed at Aldershot, our largest camp of instruction, would be much improved.

The LECTURER: I think I need add very little by way of reply, for I really have been treated very leniently by my audience, and have met with but small criticism. I may say, however, with regard to what fell from General Hildyard, that I have observed in foreign periodicals, and notably in the "Militär Wochenblatt," considerable discussion as to the matter of firing during the attack, and great divergence of opinion. I think the best opinions consider that fire should not commence until within 800 yards of the objective, and that is the view of course taken by our regulations. But there certainly seem to be not a few abroad who would utilize the great range of the modern rifle to a fuller extent. The greatest discrepancy in opinion is certainly exhibited when the final advance comes to be discussed. I must say I have doubted greatly myself as to whether firing during the actual assault, that is to say in the last rush from the main fire position, was likely to be of any value, or even whether it was not practically impossible. I desired to hear what men of experience thought on the subject, and I am sure we all listened with much interest to what General Hildyard had to say with regard to it. But how is it intended that men should deliver their fire in that final rush? Are they to stand up or kneel down, or are they to fire from the hip as they run? This is a point which still puzzles me. But at any rate I take it that the intention in our service is that firing in some way or other is to be attempted at the moment I speak of?

Major-General HILDYARD: Yes.

I feel sure we are all in agreement with the remarks of Colonel Talbot Coke, and that greater realism in the progress of the fight, and an endeavor to delay the progress of the attack, would enhance the lessons and instruction which are given by manœuvres.

General H. R. H. the DUKE OF CONNAUGHT, K. G., K. C. B.: It rests with me to thank Major May for his very interesting and well thought-out lecture. This is the second one we have had from him, and we are very grateful that a busy man like himself, commanding a battery of Horse Artillery, is able to find time to write a lecture so full of interest on questions which are occupying the minds of officers in the present day. I think the remarks which have fallen from three General officers—and I must congratulate Major May, for this is the first time I remember three General officers speaking after a lecture—show that there is a consensus of opinion that we do not give sufficient time and preparation for the attacks we carry out. Most of us will say, perhaps, that the reason is that operations must be got through in a certain time, and perhaps officers themselves are sometimes thinking of catching a train for London. But we will have to forget that and give more time to operations, and I am glad to find that General officers recognize the importance of this. If operations are not properly carried out I do not see how you can expect any semblance of reality in manœuvres. At all times to approach reality without shells in your guns and bullets in your rifles is excessively difficult. We most of us see every day most unreal situations occur in our peace operations. If we can find officers giving as much thought on the ground as they do to the operations in the war game, and as we saw on the recent staff ride in which many officers of the Aldershot District assisted, it will be a great gain to the service. With regard to a point on which great stress has been laid—the formation in which we ought to attack—there is rather more of a consensus of opinion than formerly. We must of course make use of cover, and to do so we must be in deep formation, but whether in fours or in columns of sections is a matter of opinion. In Germany the section system is in favor, and in France column of fours. Either of these formations are the best suited till yon come under artillery fire, then these formations may not be possible and you must extend, come out of perhaps excellent cover under heavy fire, and be obliged to deploy. You must recognize that circumstances are constantly changing and that the formations that would be best utilized in a wood, or when under cover, would, when you come out in the open, be the most unsuitable. In the matter of such formations you cannot lay down any hard and fast rule. I think, however, you can lay down with some certainty the principle that the officer who can worm his way through to the firing line with the least loss is the one who will bring up his troops in the handiest and readiest formation. Major May has shown us the great necessity for infantry and artillery understanding their respective rôles, and working together for one common object, viz., the sucess of the attack. We are reminded that infantry should not hamper the artillery, and *vice versa*. If both are thoroughly at one in the object in view I think there will be less misunderstanding exhibited between these arms. I am sure we were all happy to hear the good English ring at the end of the lecture, that discipline, which I always endeavor to impress, is the root of the whole thing.

As this is probably the last occasion that I shall have of presiding at a lecture

of the Military Society as General Commanding this District, I wish to thank the officers who have come forward to lecture, and others, for the marked interest they have exhibited in their profession by attending the meeting and speaking in the discussions, and encouraging others to attend.

DEVELOPMENTS OF NAVAL WAR.

By Admiral P. H. COLOMB.

[*The United Service Magazine, London.*]

SPECULATIONS as to the future of naval war, if they go beyond the probable action of those instruments we now possess, are apt to be considered somewhat futile. On this ground most writers on naval strategy and tactics confine themselves to discussing the probable results in the immediate future, of collision between the forces now possessed by different nations. Strategy and tactics are both written of from the point of view of the present, as if there were some stability about it; but almost the last thing we can predicate of the future of naval war with certainty is permanency in the character of the instruments to be used for carrying it on, or, at any rate, in the proportions in which those instruments will be employed in war.

It is true that within the last ten years all nations have made great strides in establishing a permanency of type in the different instruments of naval war, which seemed to be impossible to arrive at twenty years ago; but it must be remembered that this has arisen from two facts: one, that the nations all suddenly agreed upon great increases of naval force; and the other, that if naval force was to be increased, some types must be adopted *coute-qui-coute*. In England, at least, it is certain that the adoption of the present type of battle-ships followed the determination to make an increase; and no one knew, when the order was given to begin to build, whether the type chosen would succeed or not. And still all our types owe their present apparent stability to a consensus of opinion. We have had little or no experience as to their actual war capacity, and as we have not, opinion may change, as it has constantly changed before, and then new types, based upon new opinions, take the place of the old. Besides, even with the apparent stability of the types, we have no settled opinions as to their employment either strategically or tactically. The fact that our designs ought to be based on fixed ideas of strategy and of tactics is generally ignored; and however we may seem to have advanced, examination will show that there is no really solid basis on which the advance rests.

Not so many years ago in England our ideas of naval strategy were based on the supposition that the enemy's fleets would operate in the immediate vicinity of the shores of the United Kingdom, and we spent many millions of money on erecting and manning great fortifications

round the coast, which the plan of campaign assumed would be attacked by the enemy at the outbreak of war. We supplemented these by coast-defense ironclads, and by numbers of gunboats, each carrying a single armor-piercing gun; and neither the ironclads nor the gunboats were fit to go to sea. None of the vessels had any speed, or any coal supply to take note of, so that, unless the spot attacked by the enemy were also the spot where they happened to be at the moment, they could, after all, take no share in the defense. It was scarcely noticed that the only logical outcome of such a system was an unlimited building of forts, and an unlimited location of coast-defense vessels at every anchorage round the coast. The expenditure in this way was bound to be unlimited, as the enemy might, and probably would, throw the whole of his force on one point selected by himself, but absolutely unknown to the defenders; and so every part of the coast must be locally armed so as to defend itself against all the forces of the world. This is now recognized, but not fully, as an absurdity. Now opinion has swung round. We fairly well understand that when we have made up our naval force to equality with that which might be raised by a probable combination of Powers against us, we have come to a point at which we can logically pause. We do not think we have made ourselves absolutely secure. We acknowledge that that is impossible; but we know that up to a certain point, beyond which there are only possibilities, not probabilities, we are in a position to say that we are safe until we are beaten, and that at least we have as good a chance of victory as the other side has.

But our defense consists in the mobility of our naval forces, and our powers of concentrating them on any given point in the shortest possible time. Possible enemies are then given to understand that if they try to strike at any given point, they must expect that their forces will be struck at that point, and by at least an equal force, in this very short period of time—that is, before the attack can be fully developed. This knowledge, in the minds of possible enemies, forms a logical defense; as they cannot be expected to strike unless they have good reason to hope for success, which they cannot have under the conditions.

Opinion having swayed round generally to this view, we are found to pursue a different course in regard to torpedo-boats than we pursued in regard to coast-defense gun-vessels. The torpedo-boat, as originally planned, was just as powerful an instrument of war as she now is. The difference is that she is now sea-going and sea-keeping—at least in theory—while the original torpedo-boat was chained to her port, and was neither sea-going nor sea-keeping, like the coast-defense ironclads and the gunboats. So, when foreign nations built great numbers of these vessels, the British Admiralty, though much pressed by popular clamor, stayed its hand till it had secured a vessel in the torpedo-boat destroyer, which was sea-going and sea-keeping, and possessed the highest qualities of mobility. Then they built in profusion.

So now it may be said that the policy of design in England is based

on the idea of keeping the war away from her coasts; and it is governed by desire to obtain sea-going vessels of the highest speed and the greatest coal-carrying capacity, actual fighting force being sometimes greatly sacrificed when these ends are in view.

As regards strategy, every naval power must settle for itself whether it can drive the field of war far from its own coasts, or whether its circumstances are such as to throw it into a defensive attitude, powerless to do more than minimize the damage which must necessarily arise when the fields of battle are in its own waters. Permanency of type in war-ships, so far, can only be maintained so long as the strategical idea keeps the one condition or the other in view.

It is again so with tactics. When ironclads began to develop, there arose ideas which placed immense value on the ram as a weapon. It followed, not at all logically as it happened, that seamen began to suppose that the ram would govern the fighting formation of a fleet. The French took up the idea warmly, and held that the fighting formation must henceforth be the "line-abreast"—that is, where the ships are placed in a line beside each other so that only their bow or their stern guns are available for firing on the enemy. The notion took some hold in the English Navy, and though I myself was earnest in pointing out that the idea was a profound and dangerous mistake, as a formation in line-abreast was certain to be attacked and beaten by a formation in "line-ahead"—the old "line-of-battle"—the idea was allowed to grow. It then seemed that if, because of the ram, fleets were in future to fight in this line-abreast, it was necessary that the gun-armament of the ships should conform to it. When the idea arose, the ships were all armed so as to fight a broadside battle in the line-ahead. It was thought necessary to build ships whose whole gun-power could be exercised either right ahead or right astern. The *Inflexible*, and several ships of her type, was the result, but all that can be said about them is that it is certain no more of that type will be built, because the ram is not thought so highly of as a weapon as it once was; and because, especially since the battle of Yalu, the line-abreast is condemned as a fighting formation. In this case, idea changed, and the type changed in accordance with it, but the battle of Yalu is the only experience supporting opinion.

But, after all, the present British type of battle-ship is a compromise. The two immensely heavy guns at bow and stern are the remains of a ram battle and the line-abreast. The guns are equally available to fight a broadside battle in the line-ahead, but they might not have been so had idea not changed. On the other hand, the broadside fire of these ships is being continually strengthened in power, and in number of guns; while the tendency is to lay less stress on the right-ahead and right-astern fire. Ships are being built now that are designed to fight side by side with the battle-ships, which are more nearly like the *Warrior* and *Gloire*, so far as tactical idea is concerned, than anything we have had since the *Devastation* and the *Thunderer* were launched. The fact

is simply that we have fallen back, but only in a vague sort of way, on the belief that if we fight in fleets at all in the future, we shall fight as our ancestors did.

We do not, however, follow the conception out. Supposing that our vague imperfect conception is a true one, we are inclined to adopt it in a general sort of way, but we give no close examination, and we try scarcely any experiments to ascertain exactly how we are going. For instance, if history be closely examined, we shall see that the uniformity in type and individual force which obtained in all line-of-battle ships towards the close of the Anglo-French wars resulted from the practice of fighting in line-of-battle, and the necessity of fighting at short range. If the matter be further investigated, it will appear that though ships may again fight in line-of-battle, yet as they will certainly fight at long range, there will no longer be necessity of excluding weak ships from the line, as there was in old days. The conclusion derived from close reasoning is confirmed by the experience of the battle of Yalu, where all classes of ships fought on the Japanese side with no more harm to the weaker ships than to the stronger.

We see, therefore, how the different conceptions of the power of a weapon will revolutionize type of ship, though at the time there is no means of deciding, or at least no attempt to decide, whether the conception be justly founded, or the reverse. At present we are in face of the tremendous problem as to whether the torpedo is to rise to the position of governing type, as the ram did; and whether, supposing opinion places it in the position once held by the ram, that will be its true and lasting position, or whether it will rise to power only to fall again, as the ram did. It was at an early date proposed to build rams pure and simple to contend with, and so to supersede, the iron-clad battle-ship. They were to have been small, swift, and but lightly armored—just sufficiently armored, in fact, to insure that a numerous and yet effective fire could not be employed against them by the battle-ship. Such a ship was never built, and it is impossible to say what might have been the result, had one been built and tried. But at a very early period the torpedo, which had till then been an adjunct to the battle-ship's gun and ram power, was given a vessel to itself; and from that moment the torpedo became an independent threat to the battle-ship, which the ram had never been. That threat has been greatly developed in recent years, and the place it will take ultimately may be determined by opinion, even though that opinion is wrong.

Opinion, if there is no war, will be formed in a rough way, unless the usual naval method changes. In the days gone by, when all naval instruments rested on authority, and were governed by precedent, there was nothing more abhorrent to the naval mind than experiment, especially if it promised to be conclusive. What had been, should be, and that was enough for any sailor. But the naval mind has most unwillingly been forced out of its old groove, and now accurate experiments of

all kinds that hold a subordinate position are universally in progress. Steaming powers are accurately tested both as to speed and coal-consumption. Guns and gun-mountings, gunpowders and projectiles, the resisting powers of armor, and the effect of projectiles upon it, constantly undergo the most searching comparative experiment. So far as running powers go, the torpedo is in like case, but experiments stop short at completeness, as the weapon is rarely charged and exploded. But though so little is to be complained of in regard to the experimental method with subordinate parts of the naval instrument, there is still quite a repugnance to try those larger experiments which would enable us to draw real conclusions as to what it all may come to. When the ram was in the ascendant, it was only in Russia, under Admiral Gregoire Boutakov, that actual practice in ramming was obtained; but perhaps his experiments, which showed conclusively how very difficult it was to ram a ship which was doing her best not to be rammed, did more to discredit that weapon in England than anything which had happened since the *Re d'Italia* succumbed to it.

Take another case. The power of the torpedo-boat as against the battle-ship in open fight depends chiefly on her capacity of running through the opposing fire of the latter up to torpedo-range. So far as published experiments go, opinion in this matter rests upon some that were tried with a dummy torpedo-boat and the Nordenfelt gun in 1880. The details will be found in Brassey's Naval Annual for 1886, p. 378, and any one casually regarding them would consider it conclusively proved that a torpedo-boat would have no chance at all in making for a battle-ship in daylight, if exposed to the fire of even a single Nordenfelt gun. Such a one would merely note that when approaching at the rate of 9 knots, the boat was hit 65 times per minute; and that when approaching at 17.2 knots, the boat was hit 48 times per minute. Further consideration would show that in the first case the range was from 500 to 100 yards—that is to say, all the hits were within torpedo range; and in the second case the range was from 700 yards until close alongside—that is to say, that at least a large proportion of the hits were within torpedo range. Putting the two experiments together, a remarkable fact is revealed. From 500 to 100 yards' range 115 hits were recorded, and from 700 yards till close alongside 110 hits were recorded. The times were 1 min. 45 sec., and 2 min. 19 sec. There were fewer hits in the longer time, though the length of the range was extended both ways. There were very likely no hits at all made from 700 to 500 yards, and most probably very few until the boat was far within the distance at which she would have fired her torpedo and made off.

So far then, as published experiments in England go, opinion adverse to the torpedo-boat in the case of open daylight attacks upon the battle-ship has been formed upon experiments which do not in the least justify it. Experiments tried abroad, twelve or fifteen years ago, were even more favorable to the torpedo-boat attack in broad daylight.

The point here is, that this question is vital to the future of naval war, yet we do not really know anything about it. We hold opinions which it is possible an experiment made to-morrow would entirely upset, so that the whole position is much more unstable than it seems.

But it is not only this unstable opinion, liable to sudden change, which makes the forecast of future naval war difficult; it is that the progress of invention may be, for all we know, undermining the whole position by disturbing the balance which creates existing war-ship design.

The immense progress that has been made in increasing the propulsive power of the pound of coal destroyed sail-power, and there is no reason to suppose that development has ceased. It has, by greatly adding to the speed of the torpedo-boat or vessel, greatly strengthened the threat of that instrument of war, as against the battle-ship, and not impossibly may destroy the type.

In the torpedo itself, the improvement has been immense; it has a straighter, longer, and more certain trajectory than it originally had, and it travels at much greater speed. The experiments now going on in applying the gyroscope to the rudder may possibly extend the effective range of the weapon to 1000 yards. The destructive effect of a blow from the weapon has been continuously increased by enlarging the charge.

On the other hand, the improvement of the anti-torpedo-boat gun may really be a complete answer to the torpedo-boat. The Maxim automatic 37-mm. gun has been brought, I believe, up to a fire of 300 rounds per minute; and with smokeless powder this terrible stream of fire is sure to be much more accurate and deadly than that of the Nordenfelt gun could ever have been. I suppose we shall presently see this gun in universal employment as the only real answer to the torpedo-boat, compelling her to adopt armor as alone capable of maintaining her position.

And here, again, the inventor has his answer. The same great firm in England, Vickers Sons & Maxim, which supplies the Maxim gun, supplies also, under Harvey's and Krupp's patents, armor of such resisting power as could not have been dreamt of ten years ago. If the Maxim gun strikes at the root of the ideas which have produced the torpedo-boat, it is quite possible that the new armor will reinstate her.

I have explained how the present type of battle-ship in England, whose real origin was the French Caiman, has her roots in the idea of a ram battle, and a fleet-formation adapted to its use. The improvement in the gun itself is already tending to modify the type. To gain a desired energy it is no longer now, as it used to be, necessary to add weight to the gun. For years past the energy of the gun, which in the first instance means a better trajectory and longer effective range, has been improved without adding anything to weight. The wire-gun and modern powder, such as cordite, has a possible chamber strength far beyond the

test to which ordinary service charges put it. In the very latest development this fact has been seized on by the great firm mentioned above, which has succeeded in producing a 6-inch quick-firing breech loader, which gets a speed in unaimed fire up to nine rounds per minute, with enormously increased energy, but without much increase in the weight of the gun. The result is achieved by a combination of details in the breech mechanism and the chamber, in which the case disappears, and the cartridge-box returns to its old form. The length of the breech-piece is reduced by one-half, while the requisite strength is given by making three-quarters of the screws bearing surface, instead of one-half, as at present. The abolition of the case allows of the chamber being considerably enlarged in diameter without necessarily increasing the diameter of the breech aperture; and the margin of strength which the wire-gun allows is thus utilized.

These inventions will, no doubt, be applied to heavier guns, and it may be found that just as the improved resisting power of the armor-plates has tended to increase the armored area, while reducing the thickness, so this increase in the power of the individual gun, weight for weight, may tend to increase the number of the guns carried, while reducing their individual size. Such changes would most probably tend to alter the type of battle-ship, to reduce her size, and perhaps to allow of her speed being increased. Such a change would be, by so much, adverse to the status of the torpedo-boat.

Such, then, are the materials we possess with which to speculate on the future of naval war. It may be difficult to draw definite conclusions from a survey which discloses the contention of a variety of changing forces; but it seems to me that every man concerned in dealing with revenues which are intended to provide national naval strength is bound to speculate, and to do it persistently and carefully. The one thing apparently certain is that it is the wrong time to advocate sudden and extended additions to naval force. All the appearances indicate the instability of existing types of ships, and the probability that many, even of the latest types, will be held to be obsolete in a few years.

Starting from the idea that in reality every naval state must decide for itself whether its strategy will be to operate principally in its own, or in its enemy's waters; whether its plan of campaign in war will be to defend its coasts by a system of coast defense, or by a transfer of the theatre of war to a distance from them; the question of type of ship at once arises. Probably no sensible nation will revert to the British idea of the early seventies, and build slow, heavily armored and expensive ships, incapable of rapid concentration, as an adjunct of land-batteries. But it is a grave question for any nation which must expect to be subdominant at sea, whether the swift-going torpedo-vessel, possibly armored, and capable of the utmost powers of concentration, will not give much better coast-defense for the money than the heaviest expenditure on costly battle-ships could possibly do. For though the power

of the torpedo-vessel in attack upon the battle-ship may be disputed, there can be hardly any dispute about the want of power in the battle-ship in attack upon torpedo-boats.

If any nation possessing a powerful coast-defense of the swiftest torpedo-vessels were to find itself at war with another nation possessing a sea-going navy chiefly composed of battle-ships, it would probably find its coasts reasonably free from aggression. It would scarcely pay the other nation to expose its battle-ships in waters swarming only with torpedo-vessels. It would probably be found that the coast defense torpedo-vessels could only be driven into port by the same small, light, swift, and inexpensive craft.

Just in like manner would the nation which was compelled for its safety to transfer the warfare to the vicinity of the enemy's coast, find it safer and less costly to do it with torpedo-vessels rather than with battle-ships. The result might show that the latter could not be dispensed with as a reserve, but it can scarcely be denied that when great expenditure is incurred in providing safety harbors for the battle-ships, in which they cannot be attacked by torpedo-vessels, their employment as a reserve force is more in contemplation than as the advanced force that sailing line-of-battle ships used to be.

The difficulties of forecasting the future of tactics is greater than in forecasting that of strategy, though the questions interlace. It is as yet quite a matter of opinion, and of very loosely formed opinion, whether the future sea-fight will be between battle-ships alone, as in the sailing days; or between torpedo-vessels alone; or between torpedo-vessels and battle-ships on one side, and torpedo-vessels and battle-ships on the other side. I do not myself believe it possible to fight mixed fleets, but others, quite as competent to judge as I am, feel confident that if there are to be sea-fights in the immediate future, they will be fought on both sides by torpedo-vessels and battle-ships closely associated and intermingled.

The decision to be come to is evidently crucial and fundamental. I believe it can be truly arrived at by proper courses of experiment. But I am bound to say that were I responsible for the naval expenditure of any nation, I should not dream of large and sudden expansion until I knew the result of these experiments.

When England awoke, some thirteen years ago, to the conviction that she was in a unique naval situation, requiring dominant naval force, and that nothing short of dominant naval force could be any defense to her empire, she was quite right to follow the lead of her possible opponents, and to build what they built, only in greater number. But that would not be true policy, for a nation which must fear military more than naval attack. Such a nation should closely forecast, and by careful watching avoid the risk of throwing its money away on what might prove to be an obsolete force when she wanted to use it.

THE DUTIES IN "ACTION" OF THE LIEUTENANT-COLONEL COMMANDING A SIEGE TRAIN DIVISION.*

By Major E. G. NICOLLS, R. A.

(*From Proceedings of the Royal Artillery Institution.*)

The following remarks are intended as a sketch of the general duties that would devolve upon the lieutenant-colonel in command of a S. T. Division, when fighting his command; they are in no way authoritative, and are merely an expression of the opinions of the writer.

A REFERENCE to S. A. D., pp. 240–41, shows that a S. T. Division consists of 16 pieces manned by four companies under the command of a lieutenant-colonel, who has on his staff one adjutant, one quartermaster, two staff N.-C. O.'s and two clerks.

These 16 pieces would in all probability be divided into, and placed in, batteries of four guns each, one company of the S. T. being told off permanently to each battery.

The duties of the lieutenant-colonel in "Action" comprise all the means necessary to the proper fighting of his command, so that the most accurate and effective fire possible may be brought to bear upon the defender's ordnance and works as to effectually silence and destroy them with the least possible expenditure of ammunition in the shortest reasonable time and thus to prepare the way for the final infantry assault, by which means alone it can be hoped that the capture of a well organized and properly defended land fortress may be achieved.

To this end his duties may be summed up generally as including—

1. Supply of ammunition.
2. Regulation and strength of reliefs.
3. Control of fire.

The first two are matters of organization which it should not be difficult to provide for by regulation and on which, therefore, one feels somewhat diffident about venturing an opinion, and I do not consequently propose to do more than offer a few remarks under these two heads.

1. The instructions for the issue and supply of siege stores given in S. A. D., pp. 15–19, are very general and do not go far beyond the transfer of such stores from the Ordnance Department to the R. A., but on p. 16 it is stated that different portions of the attack should have their own advanced depots and it is presumed from this that each unit (and for siege purposes the division must be considered the unit) will

*A Lecture delivered to the Long Course Officers and N.-C. Officers at Shoeburyness, June 5, 1896.

have its own depot and be responsible for its own stores. This depot must be directly under the lieutenant-colonel, and for its proper supervision and management he will require a sufficient staff. That already allotted to him appears to be intended for camp work and discipline only and an addition must be made to it for the store departmental work. The minimum necessary would seem to be: One officer, two conductors or park sergeants and a certain number of district gunners.

This staff would probably be sufficient where one depot supplied the whole division, but, where the nature of the ground did not admit of a sufficiently large depot being formed, or the distance of batteries of the division rendered supply from such a single depot laborious and slow, it might be necessary to divide and distribute the stores into sub-depots and then a larger staff would probably be required. But, in any case, the higher and more responsible posts in the depot should be filled by men accustomed to the keeping and issue of stores, ammunition, etc., and probably the post of officer in charge of the depot would best be filled by an officer of the district establishment or a W. O., such as a master-gunner. The district gunners would probably have to be supplied by the companies.

The amount of ammunition kept in the depot should be equal to at least one day's supply to all the batteries of the division and must always be kept up to this amount. All stores and ammunition should be so arranged as to be readily issued as required.

A fixed time should be notified in orders at which ammunition can be drawn and it should only be issued on requisition by each B. C., countersigned by the adjutant, who should check the requisitions to see that more than the authorized amount is not demanded without sufficient reason. Arrangements should be made for the immediate replacement of the ammunition issued from the intermediate depots or field arsenal, as the case may be, and it would probably be convenient to fix a regular hour when this work should be daily carried out. Except under very unusual circumstances, one issue of ammunition daily should be sufficient.

2. The S. A. D. provides for two reliefs for the force composing a S. T., each relief to be on duty for 12 hours, and it will, if this is not ordered by higher authority, devolve on the lieutenant-colonel to arrange the hours at which reliefs should take place and the strength of each relief. At first sight it would appear that the simplest way to arrange them, when only two reliefs of 12 hours each are required in 24 hours, would be to divide each company in half, giving one 12 hours, beginning from a stated hour to each half company; this would necessitate the same men being always on night or day duty, which, though it has the advantage of insuring the same duties being carried out by the same men under nearly always the same circumstances, does not seem desirable, as it obliges one half company to be always on duty at night and thus deprives some of the men of their regular rest. A

better plan would possibly be to divide each company into three reliefs thus:—

Taking the strength of a company, allowing for sick and casuals, at 100 for gun detachments only and exclusive of officers, N.-C. O.'s for observing, etc.

1st relief, 40—from 6 A. M. to 6 P. M.

2d relief, 20—from 6 P. M. to 6 A. M.

3d relief, 40—from 6 A. M. to 6 P. M.

Only two reliefs would be employed on any one day, the 1st for day work consisting of four detachments who would be relieved at 6 P. M., by the second relief of 20 men only for night work; this relief can well be reduced by half, for the fire by night is certain to slack off very considerably and a sufficient fire for all ordinary purposes could probably be kept up by half the number of guns employed during the day. The 3d relief not being required for the batteries would be employed in making up what ammunition was required in replenishing the battery magazines and the depot and so on and would come on for day duty the next day. Each night relief, as it came off duty, would be absorbed into the previous day relief and not put on trench duty again for 24 hours. By such an arrangement no man would be on night duty in the trenches oftener than once in every five days.

The hour at which reliefs should be carried out is also a matter for arrangement by the lieutenant-colonel (if not determined by higher authority) and should be fixed with reference to the circumstances and time of year. Daybreak is generally considered the time when sorties or attacks are most likely to be delivered and, therefore, a good time for the reliefs to take place, as it insures the maximum of men being under arms in the trenches at that time.

3. *Control of Fire.*—This may be considered to be a tactical question and, therefore, one that affords scope for discussion and admits of some expression of opinion. The term itself, "Control of Fire," must be taken as a comprehensive one and must not be confused with the "direction of fire." By the latter it is intended to express the action of directing the fire of a certain number of guns on to a selected object, in other words, of ranging and fighting a battery; it marks distinctly the province of the O. C. the battery, on to this the lieutenant-colonel will not trespass without good cause, but, having once allotted the task, will leave the completion of it to the men best placed to carry it out, viz., the B. C.

In the expression, "Control of Fire," I include then the following which, though distinct, cannot well be separated nor placed in regular sequence. They are—

(i) Apportionment of the target among B.C.'s.

(ii) Indication of the target to B.C.'s, including any change of target.

(iii) Regulation of fire, including (*a*), the rate of fire to be main-

tained ; (*b*), the nature of the projectile to be used ; (*c*) the actual number of rounds to be fired in any given time.

(i) In allotting to each B. C. his particular portion of the work to be done, the lieutenant-colonel would, of course, be guided by the relative position of each of his batteries and the portion of the enemy's works to be attacked, selecting the target for each battery so as to obtain, as far as possible, a direct, or enfilade fire for each. The hope of the besiegers must lie in bringing a superior volume of fire to bear on the enemy's guns so as to silence them and where this superiority in number of pieces has been obtained it will, doubtless, be good policy to concentrate the fire of two or more batteries on one of the enemy's, but if this superiority of fire on the part of the besiegers is not strongly marked it seems doubtful whether it would be sound to attempt thus to destroy each of the enemy's batteries in detail, leaving perhaps one or more of them for a time unmolested to annoy or injure you. Such a concentration means a considerable waste of ammunition, as it would take, at least, 10 rounds to range each battery. Thus, to take an extreme case, supposing that the four batteries of the division were engaging four of the enemy's and the fire of all four was concentrated on each in succession, it would take 160 rounds to range, most of which would probably be wasted, whereas if each battery attacked one of the enemy's, only 40 rounds would be so wasted, and supposing that it took 100 rounds, exclusive of the ranging rounds, to destroy each of the enemy's batteries and that these rounds were fired at the average rate of 20 per hour, it would take in the first case 140 rounds from each battery and seven hours to complete the task ; in the second, 110 rounds per battery and five and a half hours, a considerable saving both in time and ammunition, with the additional advantage that probably the 110 rounds fired continuously from each battery at the same target would do its work much more effectually than the 35 rounds each fired by the four batteries at four different targets.

This is a point that will have to be taken into consideration by the lieutenant-colonel in apportioning target and it will be necessary for him to determine how best the maximum effect can probably be obtained with the least expenditure of ammunition ; but he should also be guided by the nature and calibre of the ordnance with which his batteries are armed.

Heavy howitzers like the 8″ may be expected to do at least double the work for the same expenditure of ammunition that can be looked for from the 6″ or 6.6″ howitzers.

Again, howitzers on mountings, admitting of any elevation up to 70° being given, will be available for special work that other howitzers could not do so well ; while batteries supplied with high explosive shell will often probably be more advantageously employed in some particular manner than in joining in the regular artillery duel.

All these points and probably several others must be taken into consideration in allotting their targets to the batteries.

(ii) The indication to B.C.'s of the position of the target which they have to engage and destroy is, perhaps, the most important and difficult of the lieutenant-colonel's duties in action. On the means employed to this end will depend in great measure the fire effect obtained by each battery and probably the consequent duration of siege operations.

Hitherto this question has not received the attention that its importance demands; up till now our endeavor has been, and no doubt rightly, to introduce and perfect a sound system of battery fire discipline, this, I think, we may safely admit has now been obtained, as reference to the Practice Reports from Lydd for the last two years will show, and the time now seems to have arrived when we should turn our attention to the question of how the fire of any one or more batteries is to be turned, at will, on to any one of several objectives which it is desired to destroy.

This demands some kind of target-indicator. No doubt several such instruments might readily be devised, which would, more or less, answer the purpose, but before considering the actual form of such indicator, it will be as well to remember what the general disposition of batteries and observing stations of the attack will probably be.

The principles involved are—

(*a*) That the batteries must be placed in positions concealed from the enemy's view.

(*b.*) That the observing stations must be placed in commanding posisitions, from which as much as possible of the surrounding country (especially to the front) is visible.

The O.C., the battery must be in the battery, only N.-C.O.'s or men will, as a rule, be in the observing stations. The B.C., therefore, is not in a position to determine the desirability of a change of target or to order it on his own initiative as he is dependent entirely on his observers and has no means of judging either the effect of his own fire or what points in the enemy's line are most vulnerable or most necessary to attack.

This must, therefore, necessarily become the province of the lieutenant-colonel; it is he who must determine what portion of the enemy's line each battery is to attack, who must point out to B.C.'s their targets and issue the necessary orders.

To do this satisfactorily, his own position or fighting post must be one from which he can get a good general view of the country and the enemy's works and he must be provided with—

(1) A set of observing instruments and observers.

(2) A plan of the country showing clearly the positions of his batteries, his own and all other observing stations in his command and as much detail of the enemy's works and position as can be obtained.

(3) Means of communication with his B.C.'s and his own observers.

(4) Means of indicating to B.C.'s the results of his observations and his orders thereon.

The lieutenant-colonel's fighting-post, therefore, should be, if possible,

in some central position in advance of the batteries of his division and from which a good view can be obtained.

(1) It will not do for him to have to rely on any of the battery observers for information, their attention and their instruments must be fixed on the target which their battery is, for the time being, attacking. He must, therefore, have observers of his own whose movements he can completely control and to whom he can issue instructions without interfering with the fire of any battery. These observers should be placed close to his own fighting-post; in fact, one of the instruments should be located at his post, so that he can himself use it if he wishes to, the other may be placed in any convenient situation.

(2) No doubt in a siege, plans or maps of the country, as far as they were obtainable, would be furnished to C.O.'s, but these would probably not be on a sufficiently large scale or have sufficient detail to be of real practical value to the lieutenant-colonel. It would be necessary for him to obtain what he required either by detailing his adjutant or some other officer in the division who was good at military sketching to make the required sketch, which should be on a large scale, at least 12″ to a mile, but some such scale as 100 yards to one inch is preferable. The selection of all observing stations in his command would be one of the duties of the lieutenant-colonel and this would be carried out as soon as the side to be attacked had been chosen and as far as the battery observing stations went, in consultation probably with the B.C.'s. There would, therefore, be ample time to complete such a sketch as was required before it was necessary to open fire. Such a sketch must show as accurately as possible the exact positions of all observing stations, the lieutenant-colonel's fighting-post and the position of the different batteries, magazines, etc. As far as the enemy's position was concerned, details regarding this could be filled in to scale from the maps provided. The observing stations should be numbered according to their batteries thus: R.O. (1), L.O. (3), or the letters A and B might be used for right and left observers and their positions should be marked on the plan by small circles, R.O. stations in red, if possible, so as to be easily distinguished and recognized.

(3) The means of communication with B.C.'s and the lieutenant-colonel's observers would probably be telephonic or telegraphic; it is not necessary for the lieutenant-colonel to be in communication with the battery observers, as all orders to them would necessarily be through their C.O.'s.

(4) In order to indicate to B.C.'s the direction of the targets they are to engage, two things are necessary:—

(*a*) That the lieutenant-colonel should be able to ascertain definitely the position of the target and communicate it as definitely to B.C.'s.

(*b*) That B.C.'s should be able, by the orders they give to their observers, to get them to set the instruments as required so as to be on the spot indicated.

Both of the requirements can easily be obtained by a very simple process, viz., by orienting the lieutenant-colonel's plan and all observing instruments. In the School of Gunnery Report for 1895 it is recommended that observing instruments should be fitted with box compasses and no doubt all will shortly so be fitted, the process of orienting them will then be a very simple matter, but the need for this will necessitate some alteration in our present system of setting these instruments up; instead of laying each instrument at zero on the other, we shall have to adopt the plan of orienting each instrument at starting and reading off the bearing to the target instead of the angle.* I do not suppose that there will be any difficulty in working the instruments thus; when the observers get used to it, it will be as easy as the present method.

The lieutenant-colonel's plan would, of course, be oriented, but if he is to indicate his targets with ease and rapidity, the mere fixing of the north point will not be sufficient. His plan will have to be specially prepared with this object; no doubt there are several ways of doing this, but the method I should advocate is as follows:—

Through the positions on the plan representing the observing stations, magnetic north and south lines of sufficient length should be drawn. A circular protractor as large as possible, and graduated to quarter degrees, should be used in conjunction with a straight-edge graduated in 100 yards to the same scale as the plan and constructed so that it can be pivoted on a drawing pin at the centre of the protractor.

The method of procedure would be—

The lieutenant-colonel having ascertained from a study of his map and an actual examination by glasses, or the observing instrument at his station, of the ground in view and probable position of the enemy's guns, would direct his observer on to the required spot and order him to clamp his instrument as soon as he had laid it on one of the enemy's guns; he would then set off the bearing of the instrument by means of his protractor and straight-edge on his plan and estimate the range by aid of his map, this would enable him to direct the other observing instrument on to the same spot approximately, and he would send down some such order as this to the observer: "Set your instrument at bearing ——; look out for any gun firing from that direction and send in reading of any observed at once." As soon as the other observer had succeeded in doing this, the approximate position of the gun observed could be formed on the plan by setting the straight-edge from each observer at their bearings and this spot would be marked on the plan. The protractor and straight-edge would then be placed in turn at the positions on the plan, representing the two observers of the battery whose fire it was intended to direct on to this target and the bearings from

* A method of target indicating which requires no alteration in existing method of setting up instruments and is, moreover, more accurate than the one here suggested, has been proposed by the Instructor of Gunnery at Lydd and was tried there this year with success.

each observer could thus be approximately obtained and the range from the battery measured.

The lieutenant-colonel would then send down an order of this nature to each B.C.: "Engage enemy's battery of three (or four) guns—

(Apparently) bearing from your R.O.——
" " " " L.O.——
Approximate range —— yards.

Report when target has been picked up, sending readings of each instrument."

On getting such an order, the B.C. would at once telephone to each observer in this manner: "R.O. or L.O. search for enemy's guns at bearing ——; clamp instrument as soon as one flash comes in field and send me all readings of other flashes observed." As soon as each observer had carried out these instructions the B.C. would, from an examination of the readings received, put each observer on the same gun in the usual manner and report to the lieutenant-colonel in this wise:

"Both observers have picked up target, R.O. is clamped at ——, L.O. at ——." If the readings thus received appear to correspond satisfactorily with the bearings of the target from the C.R.A. observers, the lieutenant-colonel would send in reply, "commence firing"; but if he is in doubt as to whether the observers have picked up the target which he wishes the battery to engage he would send in reply, "stand fast," followed by further instructions.

In this manner the fire of any battery could be directed on to any target and the position of it or any change of target easily indicated to each B.C. as desired. The bearings sent down originally by the lieutenant-colonel would probably only be approximate ones and absolute accuracy is not to be expected nor necessary, but if the plan has been carefully made out and the positions of the observing stations correctly marked, these bearings should be so nearly correct as to admit of the battery observers picking up quickly the required target from the instructions received from the B.C.

A word or two before leaving this subject regarding the selection and nature of observing stations and the lieutenant-colonel's fighting post. All such stations must be placed in commanding positions whence a good view of the country in front can be obtained up to a distance of about 4000 yards and through an angle of 60° at least; they should not be placed on the sky line and should be concealed as naturally as possible, not by making revetted cells covered over with boarding or corrugated iron or anything of that sort, but by utilizing the natural configuration of the ground, hedges, bushes and banks; if cover is required for the observers it should be placed close to and at the side or in rear of the stations and so as not to be in sight of the enemy.

Field observations only serve to draw fire; they may thus render some service by causing the enemy to waste ammunition which might

otherwise be used against the batteries and, even if they do not (as is probable) suffer much from such fire, they will be of little use as observing stations, for observation under fire is not likely to be reliable and therefore will be useless, if not dangerous.

Trees, on the contrary, if not isolated (and so conspicuous marks), and if fitted with platforms secured to the branches on which instruments might be placed, might often be usefully employed.

Captive balloons are quite useless for any purposes of observation of fire, though for general purposes and observation of general fire effect they might often, no doubt, be usefully employed.

(iii) Regulation of fire is a very important part of what might be termed fire economics, the object of it being to prevent waste of ammunition and to get the maximum effect from the rounds actually fired. The labor and transport involved in taking up to the front sufficient ammunition to keep up the supply of 100 rounds per gun per diem for a division is so great that economy of ammunition becomes a very important question. By economy of fire is meant not the saving of ammunition, but the prevention of waste and this can only be effected by a proper regulation of fire. If B. C.'s think they can easily obtain as much ammunition as they like to demand, they will naturally not be particularly careful of their expenditure, but if they know that the supply is limited and a vigorous account of expenditure will be demanded, they will, as naturally, try and make the most of what they have got and seek to obtain as many effective shell as possible and thus a true economy will be established.

In regulating, therefore, the fire of his division, the lieutenant-colonel will have to consider—

(*a*) The rate of fire to be maintained.

(*b*) The nature of projectile to be used.

(*c*) The actual number of rounds to be fired in any given time, say 24 hours.

(*a*) The rate of fire for siege artillery is slow fire, the actual interval to be maintained between rounds must depend upon circumstances; when a general bombardment is intended to cover the infantry assault the fire cannot be too rapid; (2) when ranging on a new target the fire should be comparatively rapid, so to obtain an effective fire on the enemy before he can so reply to yours, once the range has been obtained and the fire is to be continuous, its rate should be diminished both to economize ammunition and to save the men.

Allowing 100 rounds per gun as the normal supply for 24 hours, we get a total of 400 rounds to be fired by each battery in that time; again, supposing that the rate of fire is to be one round in every three minutes by day and that this rate is to be double that maintained at night, he should get for 12 hours a day at 20 rounds per hour, 240 rounds for night. Twelve hours at 10 rounds per hour = 120, or a total in 24 hours of 360 rounds, a number which would keep us comfortably within the

limits of the daily ammunition supply, and yet which should be sufficient to allow of an effective and well-sustained fire being kept up.

(*b*) In selecting the nature of projectile to be employed, the lieutenant-colonel's choice would be very limited, it lies, in fact, between the use of common-powder shell and high-explosive shell, any other kind of shell is practically not worth firing from howitzers. The actual choice must present a question of some difficulty to the lieutenant-colonel, for, in the first place, the supply of H. E. may be very small, in which case, of course, their use must be very limited; in the second place, he must take into consideration the nature of the target (as far as he knows it) and the effect that it is sought to produce. Experiments so far have shown that the full effect can only be obtained from H. E. shells by using delay fuses; these are most difficult to observe accurately owing to the uncertain length of time from impact until the burst is observed and, therefore, for ranging D. A. fuses are recommended, but this means that even good shell in the ranging rounds will probably be less effective than equally good powder shell and, therefore, less effect may be obtained at this stage with H. E. than by using C. S. When it is necessary to get down the fire of an enemy who has established his fire, as quickly as possible, this may become an important consideration. On the whole, the safest rule would seem to be, in most cases, especially when in doubt, use C. S. (powder).

(*c*) The issuing of orders as to the actual number of rounds to be fired in the 24 hours may seem to be superfluous after the rate of fire has been ordered, but consideration will show that it is necessary both to check the expenditure of ammunition and to admit of a proper supply being kept up in the magazines and depots. For although the average rate may be laid down, it must be remembered that, when ranging, the B. C. will have to fire comparatively rapidly; he may have to range on more than one target during this period and, while so-doing, he is certain to exceed the average rate of fire ordered; if, when he drops down to the ordered rate, he continues firing, regardless of the total number of rounds fired, he may exceed his allowance and thus be without sufficient ammunition for the next 24 hours when, perhaps, more important work has to be done. The total amount of ammunition to be fired in one day should, therefore, be ordered by the lieutenant-colonel for each battery of his division and it is to see that this amount has not been exceeded that it was suggested above that daily requisition by B. C.'s for ammunition should be countersigned by the adjutant, as he would be aware of the orders given and of the amount in the depot magazines and by thus checking the requisitions can prevent any failure of ammunition supply arising from an undue expenditure.

The lieutenant-colonel's orders to B. C.'s then would take the following form:

Projectile to be used = C. S. or H. E.

Average rate of fire = 15 rounds per hour or—
20 " " " etc.

Total number of rounds = 350 (or 400) to be fired during 24 hours.

I have endeavored to indicate above what, in my opinion, are the general duties of the officer commanding a siege train division, with the desire of calling attention to the subject so that it may not be lost sight of among the many and important questions calling for consideration from the officers of the regiment.

"COMBINED MILITARY AND NAVAL WAR OPERATIONS."

WITH SOME REMARKS UPON THE EMBARKATION AND DISEMBARKATION OF TROOPS IN THE PRESENCE OF AN ENEMY.

By Rear-Admiral P. H. COLOMB (Gold Medallist, Royal United Service Institution).

(*Papers of the Aldershot Military Society.*)

THE subject chosen by the Council for my lecture to-day, seems to me, and I believe would seem to the majority of my naval brother officers, to be one worthy of every study which could be given to it by our brothers in the army. It is true that the more striking and grander operations of the British army, as Marlborough's campaigns and battles; the campaigns in the Peninsula; and the battle of Waterloo; to say nothing of the numberless wonderful and glorious triumphs, and sometimes scarcely less glorious disasters which have befallen our arms in India, have been carried out on the land, and without the direct help of the navy. But nearly all parts of our empire which have been won by the sword, have, at least in the initiative, been won by the army and the navy jointly.

Whenever British Naval History parts with operations wholly confined to ships, and to work done on the open sea, it points to the combined operation, and generally to the successful combined operation.

If we look at the more recent parts of our war history, we see, I think, a tendency that the combined operation—when it is a forward movement—will be even more the rule of the future than it has been of the past. I do not here allude particularly to the frequent formation of Naval Brigades to operate with the army, and under the orders of the general. As a fact, this, which we are inclined to look upon as a modern novelty, is about as old as the combined operation itself. Our seamen may be better soldiers than they used to be; more steady, more under control, and with better equipment for the field than they used to possess; but I am sometimes inclined to think that their capacity for service on shore has not advanced in a much greater degree than has that of the troops with which they have coöperated. The frightful

and unexplained failures in health, in enterprise, and even in ordinary courage and conduct, which sometimes attended the military part of a combined operation, when the naval part of it was in full and efficient working order, would seem to show that the sometimes hasty levies of troops, transported over sea, did not compare well, even for land service, with the veteran seamen who manned the war-ships of the convoy.

My meaning, rather, is that year by year the sea has become of greater importance to the possessor of its command; and that consequently ports as points of attack and defense are in a much more prominent position than when nations were more self-contained.

Ports were attacked and captured over and over again in times gone by, but I do not know that any mere port, besides Sevastopol, was ever the objective of several nations in alliance for many months of exhaustive struggle and varying fortune.

It is pretty generally accepted in the navy now, that there always has been a rule of naval war which made it imprudent—if not rashly imprudent—to attempt the attack on a port or on a territory, unless the sea was secure behind the attacking force. We expect to hold, as a necessity of our existence in any great war in which we might unhappily be involved, the major part at least of that command of the sea which we held when the long Napoleonic war closed. If we find we do not hold it, our pretty strong conviction in the navy is that our troops must remain—unless we except those in distant and exposed garrison—quiescent until we have regained it.

But whether we find we start with it, as we did in the Crimean War, or whether we find ourselves short of it at first, and have to fight till we get it again, it seems certain that the combined operation will come into force very soon after we have got it. I think that we look at this as the natural sequence of events; and I also think that all history, the most modern, as well as the most ancient, shows us that we should not, on the ground of experience, be justified in holding any other view.

The question of blockade by sea has a most important bearing on this matter of combined attack, and it must not be passed by. You are all no doubt, accustomed to skim expressions by qualified naval men, as well as by unqualified writers who find themselves able to express opinions before their information is adequate, on the subject of modern blockade by sea. And I suppose your general impression is, if you have looked into the opinions as above recorded, that blockade is a thing of the past; at least, I believe that this is the opinion which has taken deepest root, and is most widely spread. There is a pretty firm knot of naval officers, however, who hold the contrary opinion. They have observed that blockade by sea as an instrument, or established operation of naval war, has had anything but a continuous history. It has been taken up and believed in; dropped and disbelieved in; and again taken up. But there is one thing certain in the course of its existence. Every half-century has seen blockade by sea closer and more effective than it

was in the previous half century. And the closest, most extended, and most effective blockade that ever was seen, was that employed in our own half-century in the American Civil War. I believe that most of you who have considered general opinion, will think that I am mistaken when I say "most effective." In a general way it may be recalled to your minds that we never before heard so much of "blockade running" as we did during that war, and I know that in the public mind, the idea—as far as there is an idea—is, that the Federal blockade was much more inefficient than that of the old sailing blockade in its highest development; but such an idea is, I am well assured, wholly fallacious.

There are blockades and blockades, differing in character according to the object in view. The blockades we have heard most about in the days of more remote naval history, were military blockades—the blockade of war-ships. And you may note this remarkable feature about them, namely, that there are very few instances of openly breaking blockade in the face of a force at all competent to meet it in battle. When military blockade was broken, it was by evasion; by the failure of the blockading fleet to watch the port sufficiently closely; by the absence of any force competent to attack that which was breaking the blockade. There were comparatively few breaches of blockade of this kind, not because of the closeness of the guard, for that was often purposely loose, as that of Cadiz before Trafalgar, but because, unless the blockaded force came out simply to fight a battle as at Camperdown, the chances of being followed up by the blockading enemy and having its ulterior designs defeated, kept it in port.

The blockade of the Confederate ports, on the contrary, was commercial; there were few war-ships in any Confederate port which it was desirable to mask, and the force blockading every port was overwhelming as against any attack proceeding from the inside. Such forces for purely blockading purposes, as those assembled by the Federals were never seen in the world before, and never before was the blockading position so tenaciously and so continuously maintained. But all the blockade running was done directly in the face of, and in the full knowledge of, these gigantic assemblages of naval force.

Steam had given to the Federals the power of a much closer watch than could have been kept up by the aid of sails alone; but steam had given to the merchant ship at least equal powers of running through the guard. We built a special class of steam vessel, absolutely unarmed; very small; and with cargo-space so reduced in proportion to driving power than in ordinary times the resulting trade would have been ruinous. But owing to the blockade, the profits were so enormous, that the merchant who built nine blockade runners, made his money, even though the Federals destroyed three out of his nine ships in the course of a few months.

Looked at thus, even the Federals themselves considered their block-

ade ineffective. In pursuit of the "Anaconda policy," their object was to weaken the enemy by stopping his trade and preventing his supply. As the most wonderful blockade pure and simple, failed, they pushed on further. They entered on the steady policy of taking possession of the outer waters of the Confederate ports, to do which it was necessary to possess themselves of the works and strategic points which commanded those waters, and they did so.

At first there existed in the Federal mind—even in the Federal naval mind—a belief that the change in naval warfare brought about by the heavy shell gun, and armor-plating, was one of principle rather than of degree. Old experience had taught that such work could never be done by the navy alone, and must be conducted as a combined operation between the army and the navy. The new lights considered that the changed conditions excluded the necessity of employing land forces, unless to garrison places captured by the navy. The work was carried out to miserable failure by the navy alone; but to perfect success by the army and navy jointly.

Lord Wolseley dwells strongly on this point in his papers on the American Civil War; but oddly enough, under the impression that the navy, and that I in particular (who had always written and spoken on his side of the question) was prepared to argue the point with him.

I think I have said enough to show you that the changed condition of blockade points to the increased prominence which might be given in future naval war to the combined attack upon the enemy's ports by the forces of the superior naval power. And I think we should not lose sight of the fact that the capturing and holding port after port in an enemy's country, as the Federals did, was a novelty in war, not wholly due to the weakness of the Confederates, but in part to the assuredness which steam had given to the sea, considered as a base of operations in the hands of the superior naval power.

The facility which steam has given to the entrance and exit of single war-ships, or even to small groups of war-ships from blockaded ports during dark nights and thick weather; and the great cost and stress which the maintenance of sufficient naval force off a port to put a check upon the practice entails, is another cause bringing the combined operations to the front. The very best blockade, the American Civil War has indicated to us, may turn out incompetent of itself, to check raiding on our mercantile marine. Its competency will depend on the advantage the enemy—even the individual enemy—may expect to gain in the matter of prizes. If it should turn out possible to get a certain proportion of fast but military weak raiders through a blockading squadron out and home, and to pass in a certain proportion of the prizes captured, it may be just as much worth the enemy's while to devote large sums to this special operation, as it was to the British speculator to expend large capital in building and working blockade runners.

We cannot say at present how this might be. But whether there

were much or little of it, a complete stop could only be put to it by destroying the raiders in the assumed shelter of their ports. The destruction of shipping in a port has constantly been the object of combined operations. We may run through a long historical list of such undertakings from the attack of Howard and Essex on the shipping of Cadiz in 1596; through our attack on the Dutch shipping in the Vlie in 1666, and the Dutch return fire upon the shipping in the Thames and Medway, to the almost chronic attacks from which the St. Malo shipping has suffered at our hands, and to the attack on Sevastopol. The object is here temporary, and not permanent, as so many joint operations of the same sort were. There is no idea of holding the place after the destruction is properly concluded, yet there may be no difference in the operation itself. Very possibly those may be right who think that more destruction of shipping in a port can now be most economically conducted by the night attack of torpedo boats. My own opinion is—and I think it is supported by growing experience, and especially by the experiments in the Irish Sea this year—that such attacks are not likely to be carried out on any large and systematic scale. They will rather, I imagine, constitute the by-play in the plot of war, ranging themselves side by side, yet I must own in a less satisfactory form, with the noble practice of "cutting out."

If I am generally right then, I think you will go with me in believing that the combined operation, where the army and navy act directly in conjunction, is likely to play even a more prominent part in the future than it has done in the past. For while there is reason to believe that the combined operation of port attack will become of increased necessity and value, the practice of combined attack by means of invasion shows no sign of retrograding. We operated thus with marked success in Egypt in 1801; then in the Crimea; then in China, and again in Egypt only the other day. The destruction of Balmaceda's power was directly due to this kind of operation, and even the casual student has thus had brought home to his mind the enormous value of the combined operation in a way that was almost wanting before.

I have for a long time held that the course of the Franco-German War might have been wholly different had France understood and been prepared for the combined operation on a great scale. France, however, had a traditional misunderstanding of the conditions to contend against; and it stood in the way in the day of her visitation. It was, you may remember, intended to make a diversion on the Baltic shores of Germany by means of the fleet and 30,000 troops; and Bouët-Willaumez sailed from Cherbourg with a portion of the fleet, in full belief that the troops would follow. They never did so, and the French admiral suffered obloquy for not doing what it was impossible he could do in the absence of land forces.

France was sure that the way to Berlin was across the Rhine. In her then position, it seems to me that it might have been by Kiel. If she

could have held a passively defensive line along her land frontier, she had ample means of capturing the port of Kiel, and landing there a great army. It is at least conceivable that the main theatre of the war might thus have been on German and not on French soil.

In considering the question of the combined operation, the first matter that presses on our minds is perhaps the vexed one of command. Our general rule in England has been separate command: the general over the land, and the admiral over the sea forces. Under this rule we have made many splendid successes, and it must be owned, many astonishing failures. In many more cases than the one to which the saying specially refers, the military Earl, with his sword drawn, has, in his own opinion at least, been waiting for the naval Sir Richard Strachan; while the naval Sir Richard has been longing to be at 'em, and yet in his own opinion, waiting for the military Earl of Chatham. Many and many a time has the naval chief said to himself, with Nelson in reference to the military chief 's movements in Corsica, "God knows what it all means"; and many a time has the military chief said with General Moore, off Cadiz, in 1800 (before he was Sir John), "This I was led into by the admiral, to whose bad management it was also owing that we did not land."

Perhaps the commanders of the sister services seldom got quite so far in quarrelling as did Admiral Vernon and General Wentworth, in 1741. I do not know that any other admiral was ever "under his daily prayers for deliverance from a gentleman (meaning the general) whose opinions he had long experienced to be more changeable than the moon." But I do not think it is to be doubted that the older history of the combined operation is the history of the quarrel, as illustrated in the relations between the admiral and the general.

When it was the other way, what splendid results followed! Witness the operations of Rear-Admiral Sir John Jervis, afterwards Earl St. Vincent, and Sir Charles Grey, in the West Indies. These two old friends sailed together in separate command in 1793, the son of the general being flag-captain to the admiral—which was a forecast and earnest of success. The operations, as far as could be, were a series of triumphs, and the friendship of the general and the admiral was life-long.

Put these two utterances together, and think of their tremendous import to those who have to carry on combined operations.

The first is that of Lord St. Vincent when writing of this expedition in after years. "Neither of us," he said, referring to Sir Charles Grey and himself, "Neither of us wrote a letter on service to the other during the whole campaign."

The second was a written order of the day by a subordinate general during the campaign. "Whereas," wrote General Prescott, "Vice-Admiral Sir John Jervis has given orders frequently on shore here, and particularly in a note dated *Boyne* off Point à Pitre, June 11th, which must have arisen from great ignorance, or great presumption and arro-

gance; if from ignorance, poor man, he is to be pitied, but if from great presumption and arrogance, to be checked. It is, therefore, Lieut.-General Prescott's orders, that in future no attention is to be given to such notes or orders, and his signature to be as little regarded as those of John Nokes or Peter Styles."

Rarely, and only in more distant times has the general been put in supreme command so as to exhibit to us the absurd spectacle of the Earl of Peterborough at Barcelona, coming to one decision at the head of the Military Council of War on shore, only to reverse it at the head of the Naval Council on board.

There are not many instances of a British admiral being Commander-in-chief by land and sea. The notable case is that of Boscawen, who was Commander-in-chief of a combined expedition to India in 1747, and again filled that office during the preparation of the combined attack on Louisburg, in 1758. His first command was distinctly unsuccessful, attributed to his want of independence in the face of technical military advice. In the second case, he was relieved of his military command just after the expedition sailed.

The notable French case is that of D'Estaing, who commanded the fleet and all the troops in the West Indies in 1779. Marshal St. Arnaud was Commander-in-chief by land and sea in the Crimean expedition.

I believe that for this country, the divided command is a fixture, and is the best arrangement that can be made. The combined operation almost invariably goes through three phases; the first, when the naval judgment is alone the safe one; the next, where joint coöperative work of almost coördinate importance requires independent command on both sides; and the last, where the business is wholly military, and the navy becomes a mere agent of supply.

If this is so, there is absolutely no preventive for those divergencies of opinion and temper which, occurring between the general and the admiral, have in our history proved so often disastrous to our arms, but a careful choice of the men in command, or near the command. Wentworth only succeeded by the accident of Lord Cathcart's death to the command of the army. Had Lord Cathcart lived, probably neither he nor Vernon would have been recalled in disgrace.

But I think the student of the history of joint operations becomes convinced of the fact that officers have for a long course of years been growing more public spirited and more reasonable than they used to be. Self-command is greater; generosity and tolerance not less than it was a hundred and fifty years ago. There is, I am satisfied, nothing like the danger of personal quarrel in the conduct of a joint operation, which our forefathers had to meet.

Doubtless, our separate ways seem no less strange, and our acts sometimes no less unaccountable than they used to seem, when the soldier is criticised by the sailor, or the sailor by the soldier. Doubtless, we say hard things of our differing methods at times. But when

business comes and our country calls upon us, I think we are better able to pocket these things than we used to be; and I am sure we are more likely to forget which pocket we put them into.

The modern condition of the war-ships has a good deal altered not only the question of direct assistance in men to the army, but also the question of transport.

In the days of sailing ships, as well as in those of steam before iron-clads, most men-of-war were efficient and commodious transports as well. In combined operation, it was customary for our war-ships to carry a large proportion of the troops on board. The French excelled in, and exaggerated, the practice. In the earlier days of steam, the carrying of troops was made a governing element in the construction of paddle-wheel steamers, and even steam-sloops had a large and roomy "troop-deck." So long as the screw-ship was but a sailing man-of-war with a screw in her, the troop accommodation was preserved.

In my own experience, three ships I served in carried troops. In a tiny little brig, during the Burmese War of 1852, we had a company of the Royal Irish on board for many weeks as a part of our fighting force. In a paddle-wheel steam frigate of only 1350 tons in the Mediterranean, a secret expedition against a piratical stronghold being determined on, a regiment marched on board us as we lay alongside the Mole at Gibraltar, and we put to sea with them, neither side having had half-an-hour's warning of what was about to happen. In a screw line of battle-ship, we brought home the 50th and 82d regiments from the Crimea, without any very great sense of crowding.

But all these things are over for the time. Our ships' companies have greatly dwindled in the numbers proportionate to tonnage, and of these so large a proportion are required for the ship's propulsion, that the fighting force, which can be employed apart from the ships, is very small indeed.

But small as our personnel is, the accommodation for them is little or none too large on board the ships, and the carriage of any quantity of troops beside them is out of the question. From this condition I must omit two great ships of the Italian navy, the *Italia* and *Lepanto*, specially arranged for troops, and capable of carrying 5000 men each, for short voyages.

On the other hand, the growth in the size and speed of the merchant steamer, especially of the passenger ship, has immensely facilitated transport. One of the difficulties of the joint operation in time past, was the great numbers of transport ships which were necessary, and of course, the larger the numbers of the ships, the more difficult it was to keep the force together in crossing the sea, and the more easily portions of it might be got at by an active sea enemy. Whereas transport and store ships for a great expedition in former times numbered by hundreds, it is probable that for the same force and material they would now only number by scores. But there is a per contra to this when we

consider the question of speedy disembarkation. We cannot have as many boats; nor for want of gangways can these boats be filled as quickly as they used to be. If the men are massed in great numbers in few ships, they cannot be dispersed as quickly as when they were already separated in numbers of small ships.

The long voyage of the sailing ship and its crowded deck space was often detrimental to the health of the troops in time past, and we constantly hear of pauses in expeditions in order to land and refresh the men. We may suppose that most of these difficulties have disappeared with steam and the increase in the size of ships, as well as the vast improvement which has been made in sea-provisions; these things we may suppose will enable troops to arrive at their destination without check, in good general health, and with a small sick-roll.

Having said so much, we now come to the general nature of combined operations.

I have already indicated these as conveniently ranged in two classes:—the capture of a port to be temporarily or permanently held; and the invasion.

We might not think it necessary to speak of these operations where the navy is but the agent of transport and supply to the army. Where it is strong enough to defy interruption by any enemy over sea, and where the enemy on land does not put in an appearance, or seriously attempt to hinder the landing. But the moment we began to consider the subject we should see that these are the very operations with which we had most to do in the past, and may expect to have most to do with in the future.

The navy must guarantee itself against interruption over sea before it can join in a combined operation, and the course of history shows that its value in attack has been chiefly as the agent of the army. Therefore in planning an expedition this must be kept in view. In a paradox it may be said that the less the navy has to do directly in a combined operation, the better for its success. In the Crimea, there was at times an apprehension that the enemy might seek to meet us at sea, and precautions on the part of the navy were taken, under a sense of that apprehension. But since then, there has never been any such fear. The navy has found that its first duty of keeping the line of communication open was already performed by the absence of an enemy capable of attacking it; and its fighting force has been withdrawn from the ships, and has joined the army and become a part of it. It is not in such cases that the paradox applies. It is only to the cases of real naval war, where the function of the naval force is to guard the communications over sea, and to take care that no interference with the operations of the land forces is offered from the sea.

In such cases the navy should not be compromised as a sea force. It has often suffered obloquy at the hands of the land force because it would not so compromise itself; and has been accused of withholding assist-

ance to the army by refusing to anchor and remain in certain positions; by objecting to land its men, its ordnance, or its stores. But it has always been right in such cases, when to agree would have imperilled the safety of the sea-line of communications.

Sir Ralph Abercrombie was sorrowfully bitter against Lord Keith, and General Moore—as already quoted—joined him in stronger language, when his refusal to anchor his fleet in a certain part of the Bay of Cadiz in October, 1800, prevented the landing of the troops. But Lord Keith was right in declining to compromise the safety of his ships, for to do so was equally to compromise the safety of the army.

But the combined operation which we have to consider, must be held to involve such points as these. It must be understood generally that there will always be limits beyond which the navy, however it may desire it otherwise, cannot go. They are limits prescribed by circumstances which man has not yet found means to overcome.

Yet it may be fairly said that steam has greatly enlarged these limits. In the combined operation, the steam navy can anchor in places and at seasons which were impossible to it when it was a sailing navy; and it can exercise a precision as to time in its movements which used to be denied it. The general result may probably be that measures can be taken with much less chance of disarrangement than used to be the case.

On the other hand, we must not carry this idea too far. Although ships are more competent to reach given points in definite times than they used to be, and though they can occupy and hold more exposed and dangerous anchorages than they used to hold, every point, or nearly every point which concerns communication between ships and the shore, which is of the essence of the combined operation, remains as it was one hundred years ago. Landings on exposed coasts are just as difficult and dangerous as they used to be.

The passage from the ships to the shore, or to the vicinity of the shore, may be made somewhat more expeditious than it used to be, by the employment of steam-boats in towing, but steam-boats cannot actually touch an ordinary shore as rowing boats do. They are too deep in the water and too heavily weighted for that sort of thing, and all that they can do is to leave the rowing boats carrying troops and material within easy reach of the shore by means of their oars.

The wind and weather have just the same power that they always had, to interfere with a landing. The surf upon an open beach is the greatest difficulty of the invader, and the greatest protection of the invaded. We are too much accustomed to regard every exposed beach as offering special facilities for landing. But as a matter of historical, as of everyday experience, the exposed beach is but the *dernier ressort*, when no other landing-place can be found. You cannot guarantee the landing on a beach from hour to hour. You may start a landing and continue the work for a few hours and find that without material change in the

weather, but by a change of tide, or a gale 50 miles off, the landing is stopped, it may be for days.

Most naval officers can recall their own unexpected, and sudden danger in surf which was not recognized till the boat was in the middle of it. I myself recall many hair-breadth escapes of this kind in my midshipman's days, and I sorrowfully recall the loss of two boats out of three, as well as of some lives in the surf upon a beach which did not appear to any of us on board to involve such dangers.

I shall give you several historical instances drawn from prominent cases, where the surf-question has got lost in the ultimate success of the work.

The open and extended beach, if you can only secure the absence of surf upon it, is no doubt the best of all landing places where speed is of importance. But as you never can guarantee from hour to hour its availability for landing at all, it seems obvious that no expedition, whose success depends on time, should choose the open beach for a landing place.

The corollary is, that if the success of an expedition depends on time, and there is no landing but an open beach, the commander who undertakes it is a mere gambler with fortune.

There is a distinction to be drawn, too, between different states of a beach. It will be possible sometimes to land infantry, when the landing of cavalry, guns and wagons, cannot be thought of. The Duke of Wellington noted this when in 1847, he supposed that ports to land cavalry and guns in were necessary to a French invasion.

I am tempted to quote to you a fine passage of Kinglake's on this head.

"Unless a man has stood in the admiring crowd which gathers to see the process of landing one horse upon an open sea-shore; and unless, whilst he carries in his mind the labor and energy brought to bear upon this single object, he can imagine the same toil gone through again and again and yet again till it has been repeated many hundreds of times upon a mile and a half of beach, he will hardly know what work must be done before a general can report to his government, that he has landed upon an open coast with 1000 cavalry and 60 guns ready for the field."

Our two great landings on beaches as well as those of the French at Algiers and the Chilian one, were effected when time was of no importance to us or to them. Nations are now credited with designs of landing on beaches when time is of the essence of success. What would become of the expedition which had anchored off an open coast with two days only available to land in, and found an impassable surf breaking on the beach steadily for a week?

From these causes then, the first requisite for a combined operation against an enemy's port or territory is a sheltered landing place. The next is free communication between the ships and the shore. This

demands a sheltered anchorage, for boats cannot be lowered in all weathers, and a very slight sea will greatly delay the passing of troops into boats.

And history is pretty clear in confirming to us by way of experience, conclusions which we might have arrived at by way of reason. The seizure of a port, harbor, or smooth water anchorage has been from first to last the usual preliminary to the occupation of territory, as well as to the capture of an adjacent port for mere purposes of destruction. No doubt instances occur when this has followed and not preceded a landing; it sometimes happens too that there is no port to be had but the one which is the objective. In the first case, it may sometimes be clearly seen that the operation was improperly conducted; in the last, there is nothing to be said.

It would be a mistake to fix our minds on the idea that the successful attack of a well-fortified port, or even on one ill-fortified, generally has been, or ought now to be, carried on from the sea directly. The large majority of these attacks in the past have gone through the regular phases of the seizure of an unguarded, or slightly guarded smooth-water anchorage; then the advance of the army by land, while the navy blockades by sea; then the attack, to which the navy only contributes by way of diversion.

The position of the combined forces making the attack is, after the landing, fitly illustrated by that of Wellington behind the lines of Torres Vedras, and supplied and reinforced from the sea.

Generally speaking, the navy has done its active work when it has conveyed the army and landed it. After that, its active work is confined to blockading the port or ports of the enemy and guarding the sea communications of the army. Not unfrequently, however, it happens that the advance of the army is more or less along the shore. In this case, the navy assists the march by guarding the flank which rests on the sea, and if there is a battle in this position, the navy can usefully shell the sea-flank of the enemy, and make it easy to repulse all attacks on that side.

Such is the usual course which successful combined operations have pursued. The practice has followed from the facts that there generally have been few well-defended ports, which have not in their vicinity some ill-defended smooth-water anchorages. The one has generally been the stepping-stone to the other. The impossibility of making every smooth-water anchorage impregnable, was noticed by Sir Walter Raleigh some centuries back, and I have read within the last year or two in words from an able French military pen, similar arguments applied to French defensive policy.

There have been a few cases where no other attack but that direct from sea has been feasible; and there have been cases where it has been made on a great scale and has failed. Sometimes it is clear that in these cases it should never have been made at all, and where it was plain that

the combined indirect attack should have been chosen. Sometimes such an attack, though desperate, has, being the best or the only one, succeeded. In such cases the army has borne a subordinate part, or has not really combined with the navy, being only used to occupy and hold what the navy has taken. History seems to condemn such methods when there is a choice, but where there is no choice, desperate courses sometimes succeed.

I propose to run rapidly through sketches of some of the most illustrative cases of combined operations, and to conclude with an attempt to draw out some of the lessons which present circumstances seem to offer to us.

Minorca, you will recollect, has been conquered and reconquered by combined attack, four times. *Vide* Plate I. From the Spanish and French in 1708; from the British in 1756; again from the British in 1781–2; and lastly from the French and Spanish in 1798. Repeated attacks on the same territory ought certainly to gives us some clear ideas of how it is done.

In 1708, Lord Mahon tells us that the naval people were so much against the expedition, that the general, in order to force their hands, declared he would proceed from the Spanish coast, where he was, and wait in his transports off the island. I cannot, however, reconcile the admiral's movements with any stories of this kind, but I can easily understand that, as the coast of the island may not have been well known, there was high debate as to the place of landing.

General Stanhope had about 2600 men with him; and Sir John Leake, the admiral, had a considerable squadron. There was no apprehension of any interference by sea.

The landing of the troops—or of a part of them—seems to have taken place in some coves at Bini Paraing, between five and six miles from Fort St. Philip, the guard of Port Mahon, and the stronghold of the island.

Whether the landing here was complete or not, it is difficult to say. It is certain that the necessity for a sheltered anchorage was soon felt. The next best harbor to Port Mahon in Minorca, is Port Fornelles on the north coast. This was guarded by a small work, garrisoned by 50 men. Two powerful men-of-war reduced it, and this harbor became the base of the operations. The admiral took up his rôle of watching and blockading. The main body of the army marched upon Fort St. Philip, while a detachment reduced Ciudadella.

If I am to accept the dates which appear most correct, the landing was on the 1st and 2d of September; Fort Fornelles surrendered on the 9th; Ciudadella on the 11th; the batteries opened on Fort St. Philip on the 17th, and the place, with a garrison of only 1000 men, surrendered next day.

In 1756, 12,000 or 15,000 men under the Duc de Richelieu, supported byAdmiral La Galisonière with twelve sail of the line, were landed at

Ciudadella. The town, surrounded by a rampart, is approached from the sea by two creeks, very commodious for landing, and there is good anchorage close to the shore. The landing took place on the 18th of April; Ciudadella fell at once, and meantime La Galisonière employed his ships in watching and blockading Port Mahon and Fort St. Philip, where General Blakeney had drawn together a garrison of 2500 to 3000 men, with fair supplies, and was prepared to hold out for a time. The French invested Fort St. Philip on the land side, and proceeded with the usual siege operations.

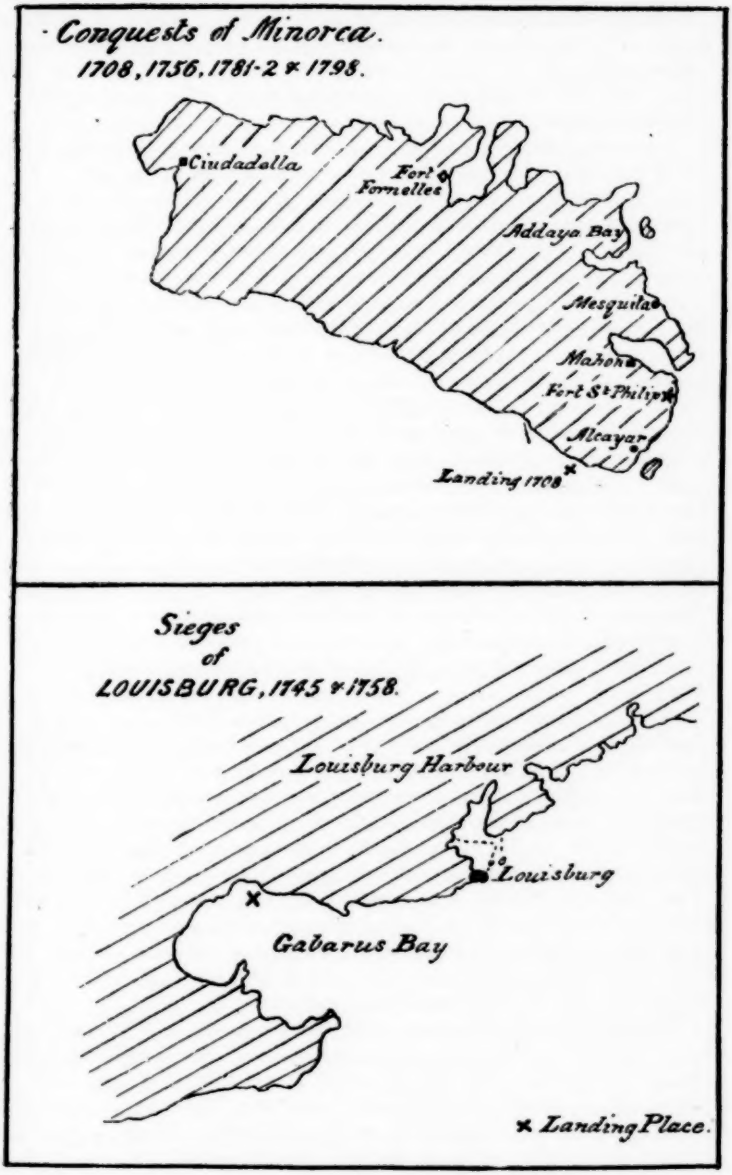
Admiral Byng, with thirteen sail of the line appeared in sight on the 19th of May, when the French had been a month on the island; and next day the indecisive battle was fought which brought about Byng's condemnation and death. General Blakeney, surrounded by vastly superior forces, and having no hopes of relief from the sea when Byng's topsails disappeared to the southward, held out until the 30th of May and then capitulated.

On the third attack in August, 1781, the Spanish army under the Duc de Crillon was originally 10,000 strong. It was escorted towards the island by a great Franco-Spanish fleet under De Guichen and Cordova, but only a small squadron actually reached the island to support the troops. A detachment was first landed at Ciudadella, and easily effected its reduction. There was an idea, that in former attacks, long marches and delays had enabled the garrison of Fort St. Philip to strengthen itself, and accumulate provisions, which might be prevented by a more direct and sudden attack. Consequently it was determined to land the main body of the army at Mesquita, on the northeast shore of the island, where there are well-sheltered creeks and coves.

On passing round the southeast point of the island where there is anchorage somewhat sheltered by a small islet, a strong detachment was left under Brigadier-General Colas, with orders to land at Alcazar. This appears to be a more exposed landing place, and the landing was in consequence delayed thirty-six hours.

The landing of the main body under the Duc de Crillon, was unopposed, but though the rest of the island was immediately overrun, and 6000 additional French troops landed, Fort St. Philip, under General Murray, held out in hopes of relief from the sea, which never came. In the end, the garrison succumbed to famine and disease, and having held out for five months and a half, capitulated on the 4th of February, 1782, being then reduced from a strength of 2700 to only 660 effective men.

On the 7th of November, 1798, Commodore Duckworth appeared off Port Fornelles with two sail of the line, four frigates and smaller vessels, three armed, and several unarmed transports, carrying a small body of troops. The intention was to land in the port, but the wind blowing directly out of it, the ships were unable to beat up, and the first part of the landing was then arranged at Addaya Creek, a sheltered harbor nearer


Conquests of Minorca.
1708, 1756, 1781-2 & 1798.
Ciudadella
Fort Fornelles
Addaya Bay
Mesquila
Mahon
Fort St Philip
Alcayar
Landing 1708
Sieges of LOUISBURG, 1745 & 1758.
Louisburg Harbour
Louisburg
Gabarus Bay
× Landing Place.

to Port Mahon than Port Fornelles, but not so commodious. Here, much of the landing was effected unopposed, but a couple of frigates being able to work up and silence the small fort guarding Port Fornelles, and the wind permitting it, the transports moved to the more secure anchorage, and the landing was completed there. The Spaniards had long before destroyed the stupendous works of Fort St. Philip, so that there was no place in the island capable of resisting us, and the conquest was completed without the loss of a single man on our side.

In considering the histories of these various attacks, we must remember that not one of them has been written from the point of view we now desire. Consequently, unless we have direct statements as to what was done, we are left to conjecture.

But some things remain pretty clear. In every case, the navy was but the handmaid of the army as far as attack went, and its direct operations against the enemy were confined to twice reducing the fire of a small work, and to blockade.

As to landings, we have direct statements that in two of the cases it was necessary to secure the sheltered anchorages, and that, though the landings are stated to have been, in most of the cases, made from ships in more or less exposed positions, care seems generally to have been taken to secure sheltered landing places, and that, in one case, failure in this respect led to delay. We do not read, in any case, of strong opposition to the landings, from which we may perhaps infer care to avoid it on the part of the attacking force.

Another excellent illustration is offered by the Port of Louisburg in Cape Breton, which was twice the objective of combined operations which were carried out on the same lines and which were both successful, *vide* Plate No. I.

Louisburg harbor is on the east coast of Cape Breton and is the only good one on that coast. In 1745, it was of great importance to the French, by whom it was held. The harbor lies parallel to the coast, or northeast and southwest, with a length of two and a quarter miles, and a breadth of half-a-mile. The entrance is apparently wide, but is closed by shoals surrounding three islands, so that the King's Channel on the north side of the entrance is but four hundred yards across. The town stood on the south side of the entrance, and if works of the most elaborate character, and guns numbering several scores, could make it so, was a very strong place. The entrance to the harbor was specially guarded by a powerful battery on an island. The garrison consisted of 1200 Regular troops, and there were auxiliaries.

Manifestly the place was, for those days, very strong; so strong as to put a *coup de main* out of the question. It was not on the spot, therefore, that the real weakness was to be found. The greater inlet of Gabarus Bay, about four miles to the southwest, afforded anchorage and landing places which were sheltered from all winds but those from the south. In 1745 there were no defenses whatever on the shores of this

bay, and it seems that if the defenses of Louisburg had been only one-half, or one-third of their nominal strength, the immediate objective of any expedition must still have been Gabarus Bay.

In 1745 it was proposed to attack Louisburg with a land force of 3850 volunteers, under General Peppernel, raised hastily at Boston, to be carried in eighty-five transports, assisted by eight 20-gun privateers and ten smaller vessels, and covered by a naval force of four large ships under Commodore Warren.

The rendezvous was Gabarus Bay, and the ships arrived there on the 30th of April. Warren watched and blockaded the mouth of the harbor of Louisburg. Some of the lighter vessels remained to cover the landing of the troops in Gabarus Bay, which was for a moment opposed by a detachment of 100 men. These were at once dispersed, with a loss of 11 killed and prisoners to the British, who on their side suffered no loss whatever.

The troops speedily began their advance upon the city, making the attack in the usual way, and continuing it chiefly at the western-most corner, where the left flank of the attack rested on the water. Supplies and reinforcements arrived in Gabarus Bay from time to time, while Warren absolutely cut off those destined for the town. He at first confined himself to this close blockade, but presently he made a dash at the island battery, which, at the moment, was only garrisoned by 14 men. No less than 500 of our men were told off for the attack, but aided by a sudden fog, the island battery beat them off. A second attack was disastrous; the island having been reinforced, its garrison defeated our attack with 320 men, and inflicted on us a loss of 36 killed and 118 prisoners.

But observing that there were no defenses on the north shore at the entrance to the harbor, Warren landed a party there by night, which, before daylight, had erected a battery commanding the island.

The siege went on through the month of May and to the beginning of June, when news of further reinforcements and supplies on their way raised the hopes of the besiegers; while, simultaneously, news reached the besieged that the hoped-for relief from Brest was frustrated by the action of a British squadron there.

On the 15th of June a flag of truce brought offers of surrender. Terms were arranged, and the French flag was struck on the 17th of June, the siege having lasted 47 days.

Louisburg went back to the French at the peace of Aix-la-Chapelle, but in 1758 it was again attacked by the British, under Admiral Boscawen for the sea, and Generals Amherst and Wolfe, for the land forces. The method pursued was, in plan, identical with that of 13 years before. The assemblage and landing was in Gabarus Bay, and Boscawen acted generally as Warren had done. The differences were that the want of complete shelter in Gabarus Bay showed itself to such an extent, that though the ships were safe enough, and the boats also, as long as they kept clear of the shore, the surf was so heavy that it was five days before

the troops could land, and they were harassed by being several times put into the boats and withdrawn from them on the hopelessness of an attempt at landing becoming manifest.

The enemy, too, had strengthened his weak point by the erection of some works along the north shore of the bay and showed every sign of vigorously opposing the landing, but this difficulty was as nothing to that caused by the surf. This continued from the 2d to the 7th of June too great to be faced. But at midnight on this latter day, there being signs of smoother water, the troops began to pass into the boats, and at the first streak of dawn, a selected group of war-ships opened heavily on the batteries and defended points, which were silenced in a quarter-of-an-hour. The troops then, in three divisions, pulled for the shore, threatening two points to the right, but making for the real landing place far up to the left, where it was more sheltered, and proceeded to land. Wolfe's division was the first to disembark and was received by a heavy fire from a wood in front, and on the higher ground which everywhere borders the north shore of the bay. The troops, however, made short work of this resistance, and the defenders fled to the town. The losses in landing are not stated in the accounts I have met, but the surf was the worst enemy, and 100 boats were destroyed, with much loss of life in this way.

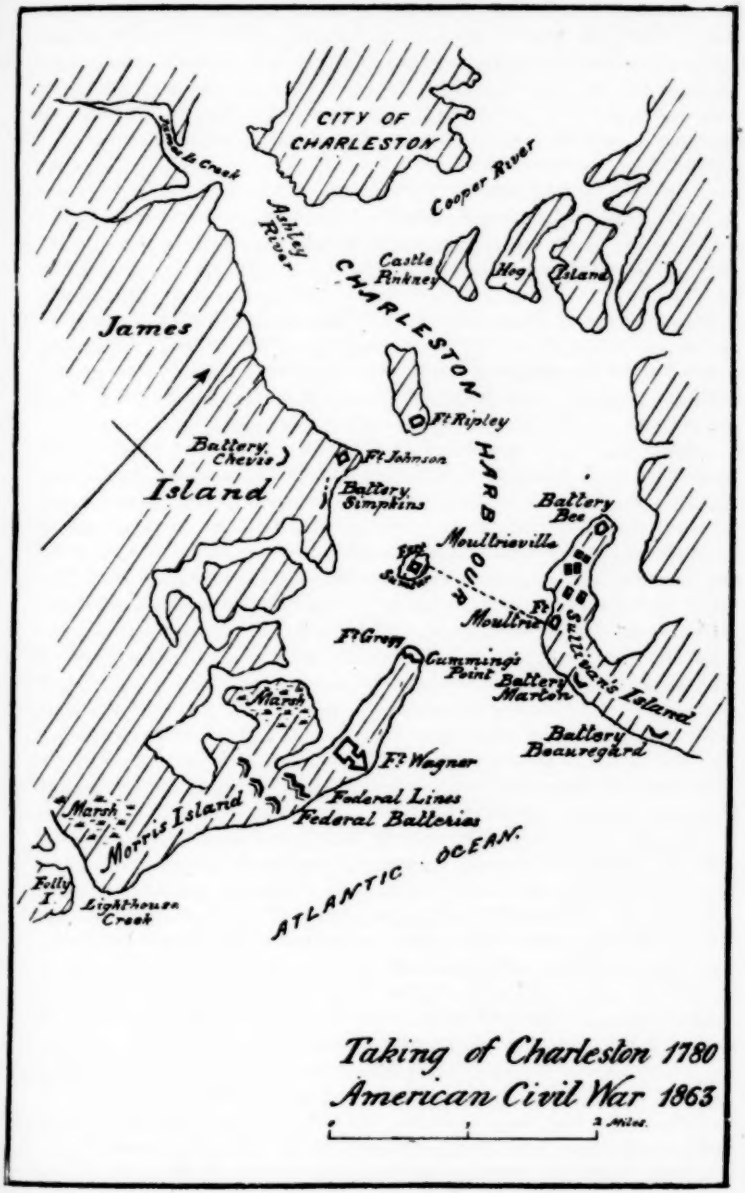
Once the footing was made good, almost everything went on as on the former occasion. In order to establish a battery on the north side of the entrance to Louisburg, Wolfe went right round the harbor, and the battery erected controlled the fire of the island battery as before. There were some war-ships employed to guard this entrance which there had not been on the previous occasion. Some of these, Boscawen carried with his seamen, but he made no other direct attack.

At the end of about seven weeks, just the time formerly occupied in the reduction, Louisburg surrendered to the land attack.

You can see that all this is parallel to the several attacks upon Minorca, and the repeated attacks on the same places, point to almost stereotyped methods. The attack seeks always sheltered anchorages, sheltered landing places as far as they can be got; and then makes a purely military advance upon the place, while the navy guards the communications of the landed force on the water, and cuts off supply to the enemy by sea.

Nor is there any change discernible in our most modern illustrations. Charleston, in America, offers us the example of a place, or rather of a port, for the town was not always the objective, attacked against rule and in accordance with rule—so to call it—both in the days of sailing ships and in our own time. In 1776 and in 1863, Charleston was attacked directly by the navy without the army, base, and both attacks failed. In 1780 and in 1863, the place was attacked in the form already described and illustrated, and the attack succeeded, *vide* Plate No. II.

Referring to the plan, it is to be noted that in 1776 the chief defenses


CITY OF CHARLESTON
Cooper River
Ashley River
Castle Pinkney
Hog Island
CHARLESTON HARBOUR
James Island
Ft Ripley
Battery Chevis
Ft Johnson
Battery Simpkins
Battery Bee
Moultrieville
Ft Sumter
Ft Moultrie
Ft Gregg
Cummings Point
Battery Marion
Sullivans Island
Battery Beauregard
Ft Wagner
Federal Lines
Federal Batteries
Morris Island
Marsh
Folly I
Lighthouse Creek
ATLANTIC OCEAN
Taking of Charleston 1780
American Civil War 1863
2 Miles

were the works on Sullivan's Island on the north side of the harbor. It was intended to have made a subordinate attack by land forces on the rear of these works, but the troops landed to the northward, found their advance checked by an arm of the sea, and the attempt was made to subdue the forts by a front attack from the ships of war. These were thoroughly beaten after ten hours bombardment, two of the larger ships alone losing 190 men between them.

Taught by an experience which, indeed, should never have been required, General Clinton and Admiral Arbuthnot used Stono Inlet, ten miles to the southwest of the entrance to Charleston harbor as their base. There was water communication between this port and the rear of Charleston, and here 7500 men were landed. The next step was to reduce the navy to its proper and subordinate position by sending all the line-of-battle ships, six in number, back to New York. There remained seven frigates, into one of which Arbuthnot shifted his flag, and a sloop—an ample force to support the military operations, but incapable of undertaking direct attack to any extent.

There was a small naval force in Charleston, and this offered some resistance to the diversion created by Arbuthnot in gradually pushing up the main ship channel, and into the harbor.

Clinton's objective was the rear of the town, and on the 29th of March, nearly a month after their landing, the troops crossed the Ashley River with the help and support of the boats of the fleet which had come up from Stono Inlet. On the 9th of April, Clinton opened his batteries in rear of Charleston, and Arbuthnot's small force ran the gauntlet past Sullivan's Island and anchored, as was believed, out of gunshot of the Charleston works. The seamen were then employed in carrying detached batteries guarding portions of the harbor, while Clinton, reinforced by troops marching from the south, and also coming by sea from New York, prosecuted the regular siege. On the 8th of May, General Lincoln in command at Charleston was summoned; on the 11th, the place capitulated.

In March, 1863, the Federals were in full command of the sea, and were persuaded—though all evidence was against it—that the new ironclads and monitors had changed the nature of naval warfare, and were competent of themselves to effect the capture of the harbor of Charleston. But even in this view, a smooth water-base was considered necessary, and was found in North Edisto Inlet, an excellent but ill-defended harbor, 20 miles southwest of Charleston. From thence, in the beginning of April, the *Ironsides* and 8 monitors sailed to make a direct attack on Fort Sumter and the other fixed defenses of Charleston.

It is not necessary here to go into details. It is enough to quote Admiral Dupont's summary of the result of the attack.

"No ships had been exposed over forty minutes, and yet in this brief period—five of the ironclads were wholly or partially disabled, disabled too (as the obstructions could not be passed) in that which was

most essential to our success—I mean their armament, or power of inflicting injury by their guns. I was convinced that persistence in the attack would only result in the loss of the greater part of the ironclad fleet, and in leaving many of them inside the harbor to fall into the hands of the enemy."

One of them, the *Keokuk*, was in fact so injured, that she sank next morning.

This failure determined a return to the old and tried form of combined attack. "Of course," said the Admiral, in settling the naval arrangements, "the most that is expected from the action of these vessels is to relieve the troops as much as possible, and to be considered of no other consequence."

General Gillmore, who with Admiral Dahlgren, held the command of the new attempt, was already in possession of Folly Island to the southwest and was already using the old sea-base of Stono Inlet. Morris Island was, however, held by the Confederates, and the simple plan was to push on to displace them, supported on the right flank by the ships. From Morris Island, Fort Sumter might be destroyed, and the fire of Sullivan's Island so controlled that the inner waters of the harbor would become tenable by the Federal blockading fleet, which was the sole object in view.

The strength of the method of attack was recognized. On the 10th of July, Gillmore opened his batteries against those of the enemy on the southern shore of Morris Island. Early the same morning, four of the monitors crossed the bar and took the Morris Island batteries in flank. By eight o'clock the Confederates began to abandon their southern works, and to make towards Fort Wagner. The monitors followed up, searching the sand hills which were capable of concealing troops, as they proceeded. The Federal troops, covered by the ships, pushed on. From 9.30 A. M. to 6 P. M. the ships engaged Wagner at 1200 yards range, while Gillmore advanced to make his assault upon it. Then they withdrew out of fire for the night. In the morning, Gillmore informed Dahlgren that he had assaulted Wagner and been repulsed. On the 19th of July the ships got within 330 yards of Wagner, and between their guns and those of Gillmore's batteries the work was silenced; but an assault made at night by the troops was again repulsed.

Active operations on Morris Island were now suspended, while preparations for renewed attack went on until the 17th of August; but there was a diversion by way of Stono River, very much in the form of Clinton's advance in 1783. On the 17th of August, Gillmore's batteries began to play on Fort Sumter, while the ships engaged Wagner and Cuming's point batteries at short range, and Fort Sumter at long range, but there was very little reply. Sumter was shortly reduced to ruins by the land batteries.

On the 2d of September, the demolition of the forts enabled Dahlgren to take his ships to within 600 yards of Sumter, and on the night of

the 6th, the Confederates evacuated Morris Island. Sumter, powerless now for offense, was yet able to repulse a boat attack directed against it by the admiral.

But by this time, the immediate end of the Federals was attained; they were in possession of the inner waters of the harbor, and had a control in blockading which they in vain wished for as long as their only anchorage was outside the bars.

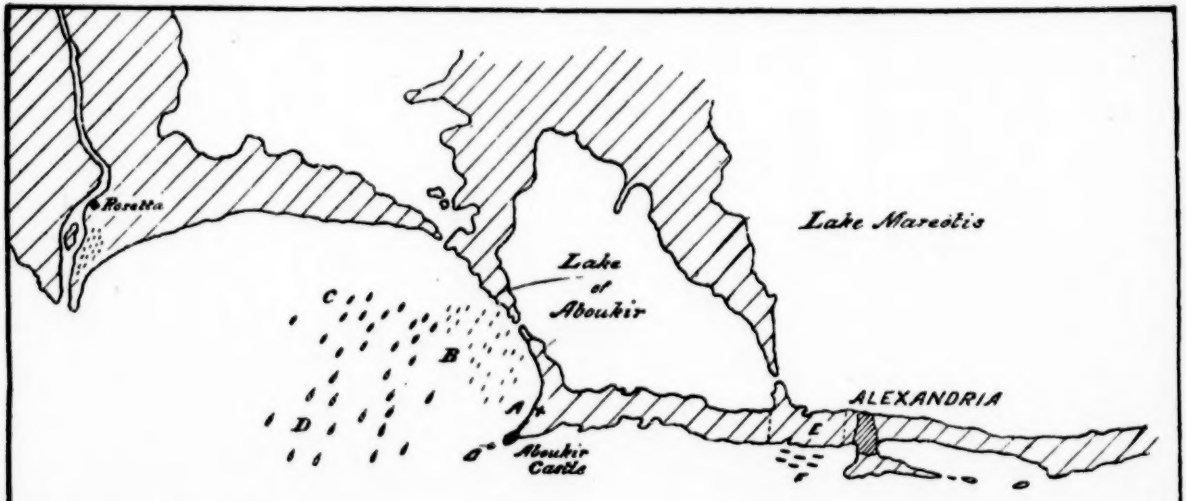
No doubt, we must not push analogies too far in matters of this sort, but I think these Charleston attacks are confirmatory of what has been said.

I might add, too, the capture of Fort Fisher, one of the last of the great Federal combined operations. It was three times attacked. First by an explosion vessel of the usual harmless character; secondly by a most gigantic naval force, equally futile; and lastly by 8000 troops operating from the rear and assisted by a naval front attack. There were but 2300 men in the garrison, from which we may infer that the great naval preparations were more or less waste.

Perhaps it is hardly necessary to emphasize the lessons so far taught us by recalling the failure of the direct attack on the Taku Forts in 1859. This was an attempt by the navy alone, obviously made in defiance of all rule, and only justified by a disbelief in the enemy's skill and courage which could not have been held in regard of European troops; we attacked first with the ships, and then by landing stormers, unquestionably in the manner most conformable to the wishes of the defenders. We suffered a grievous defeat, losing three ships, 80 men killed, and 350 wounded, many of them mortally.

It is not perhaps just to draw a full comparison between the failure of 1859, when the attack was in despite of experience, and the success of 1860, when the Pehtang, a river a few miles north of the Peiho, but undefended, was made the base of operations, and the troops marched upon and captured the Taku Forts. It may not be just because the force employed on the latter occasion was so much greater than that employed on the former. But it is difficult not to remember that the pattern of the successful attack with steam and all modern appliances in our own time, was still the same as that successfully employed by our ancestors.

I must part now with this kind of attack, and consider for a little the form of attack which, though rare in Naval History, is more romantic in character and has been more impressively illustrated than those business-like operations of which I have spoken so fully. I mean the landing upon an exposed beach, presumably from an exposed anchorage, without any sheltered base, and against possible opposition. With the example of the descent upon Egypt, in 1801, and the still more recent and important landing on the beach of the Crimea before us, it is no wonder that we should conceive this to be the form of attack most readily to be undertaken by ourselves, and more probable to be in the contemplation of enemies.



A. Landing Place.
B. Small Craft.
C. Transports.
D. War Ships.
E. Battle of Alexandria.
F. Gun Vessels taking part in the battle.

Egypt. 1801.

Landing at Aboukir Bay & Battle of Alexandria.

Abercrombie's landing is full of lesson, in whatever way we look at it, his army had, in the autumn of 1800, made an abortive attempt upon Cadiz. It received its orders for Egypt on the 29th of October, but the landing was not effected until the 8th of March next year.

Some sheltered port of rendezvous was found to be a necessity, and Marmorice Bay on the coast of Asia Minor, 345 miles from Alexandria, and one of the finest harbors in the world, was chosen. The fleet of 175 war-ships and transports was assembled there, with between 15,000 and 16,000 men on board, by the first of January, 1801. It sailed for Aboukir Bay on the 23d of February; it anchored there on the 2d of March, more than four months since the receipt of the order, and the troops landed in the face of opposition on the 8th of March, gaining the victory of Alexandria on the 21st, *vide* Plate III.

The time thus occupied, considering that the army was actually afloat when the order was received, no doubt strikes us as very long. I think we must not omit to take note of its length, though we must not fail to remark that the wind, an element less powerful now, had a great deal to say to delaying transport. Another cause of delay was the hope of reinforcement in the matter of horses and gunboats from the Turks, which never came. Though I suppose the rendezvous at Marmorice would have been made in any case, yet I doubt if the stay there would have been so long had it not been for the hope of a Turkish contingent. But one of the advantages of Marmorice was the exercise in landing troops which was constantly carried out there.

The warships which convoyed the transport flotilla, were 7 line-of-battle-ships and a frigate; but there were besides 23 armed store and transport ships, which, for all purposes in view, represented considerable naval force. In the absence of the expected Turkish gunboats, the supply of this class of vessel was small, and it had a peculiar effect upon the landing. The water bordering Aboukir beach is very shallow. The three-fathom line is a mile and a half, and the four-fathom line three miles from the beach. In the absence of small craft, covering fire was very deficient. We read that during the days before the landing, the French were in view continually erecting intrenchments to oppose it, and yet they do not seem to have been interfered with at all.

From the 2d to the 7th of March, everything but the weather was ready for the landing. The wind blowing more or less into the bay, and the sea, were inimical, and our people had daily the pleasure of seeing preparations for resistance going on.

At length, at 2 o'clock on the morning of the 8th of March, boats were lowered and the troops passed into them. At 3 o'clock the order was given to rendezvous beside the *Mondovi* and other small vessels anchored a gunshot from the shore. Two bomb vessels and three other small vessels were moved near enough to cover the landing, but it is obvious that this was a mere nothing. Had it been possible, which it was not because of the depth of water, the heavy ships would have

taken the covering position, and cleared off the enemy before a man landed.

It was 9 o'clock before all was ready for a dash upon the beach. The troops were under Major-General Coote, and the boats under Sir Sydney Smith. The total numbers were 5778, to which were added 112 artillery and 350 seamen with 14 guns. 4878 troops were carried in 50 flat boats, 37 launches, and 84 "row boats." 900 of the Guards were in smaller boats; and the seamen and artillery in 14 launches and 14 "row-boats." The men had each 3 days' provisions and trenching tools, and the boats were divided into 4 divisions, each under command of a captain in the navy. The only arrangement for firing during the advance appears to have been 3 gunboats and 2 ship's launches on the right, and 2 gunboats and 2 ship's launches on the left flank.

The landing beach was about three miles long. In the rear of it were high sand hills, especially one very steep one in the centre. Behind the shelter of these, the enemy, about 2000 strong with twelve guns, had posted himself, having his left flank covered by the castle of Aboukir, which formed a serious opponent to our right, and no doubt curtailed the length of the landing front, and pressed the whole landing away to the left.

Shortly after nine o'clock, the line being extended I suppose about a mile from the beach, Sir Sydney Smith made the signal to advance, which was obeyed with vigor. At first the French fire, confined to artillery, was wild, and did little mischief, three boats were struck but most of the men were saved. When within 300 yards of the shore, the enemy's small-arms opened, and the fire became very destructive. But our great superiority in numbers made it certain that the enemy would not stand. The rush to the shore was rapid, and the men leaping out, as rapidly formed and advanced. By the time 2000 men were on the beach, which must have been but a very few minutes, the enemy abandoned half their guns and fled, pursued by our breathless and eager troops. Our loss was given as 651 to the army and 94 to the navy in killed and wounded, while that of the French does not appear to have been half the amount. As soon as the boats had cleared their first cargoes they returned for more, but after the first rush, the completion of the landing was a matter of leisure.

Such was the descent upon Egypt; one of the few cases where the landing has been effected on an exposed beach, and one of the rare cases in which the landing was seriously opposed.

The battle of Alexandria followed, which was a combined operation, inasmuch as a body of seamen assisted, and our right flank was covered by the fire of gunboats. It is a curious thing that though the French attack was on our right, and though French authorities set down their defeat in a great measure to this flanking fire from the sea, we say nothing about it. As a fact, the strength of our position, after we landed, and the ease with which our advance was made, rested much on the fact that both our flanks were covered by gunboats and launches.

The launches on the left flank could not advance into lake Mareotis, so came hardly, if at all, into play at the battle of Alexandria, but if the French had made their true attack on our left, they could not have thrown it back, without at once coming into collision with a force that was independent and difficult to dislodge.

A landing on a comparatively open beach, which is not often noticed, but was nearly as great an operation as the landing in the Crimea, is found in that of the French at Algiers in 1830.

The naval force was some 9 sail of the line; 23 frigates; 70 smaller vessels; 377 transports; and 230 boats—I suppose special boats—for landing troops; the admiral was Duperré. The military force was 37,500 men, 180 guns, and 4000 horses, under Marshal Bourmont. There were 8 steamers amongst the ships of war.

The expedition sailed from Toulon on the 25th of May; it was driven to shelter under the lee of Majorca on the 27th; it came in sight of Algiers on the 29th, but the weather proving hazy and the wind strong and adverse, the somewhat dispersed fleet fell back to Palma Bay in Majorca. The ships sailed again on the 10th of June and were again in sight of Algiers on the 12th. Again, strong easterly winds forbade all hope of landing, and the fleet stood to sea. It is said that most officers had by this time given up the landing as hopeless, but that two of the younger captains in the navy persisted in its feasibility. There exists about 11 miles west of the port of Algiers, a small peninsula, called Sidi Faroug, jutting out into the sea, and necessarily sheltering the beach to the eastward when the wind was west, and to the westward when the wind was east. Under such shelter it was determined to effect a landing. The place was more especially recommended as there was good, if unsheltered, anchorage for the ships, and as there was no cover on shore to assist opposition.

Off this peninsula the flotilla arrived on the 13th of June, and the wind being moderate now, and from the eastward, preparations were made to land on the sheltered beach to the west. Some slight works which fired without effect, were easily silenced by the steamers, and at daylight on the 14th the disembarkation commenced. The French pushed inland against some opposition, and then intrenched themselves so as to constitute the peninsula a secure depot.

As far as I am informed, the mass of the army was got on shore in two days only. Certainly in a very few days it was able to advance, give battle to, and utterly rout some 40,000 Algerines which had assembled to dispute the passage to Algiers.

I need not describe at any length our landing near Old Fort in the Crimea. It is familiar to us all, and the story has only lately been retold with all the skill and fascination which belongs to Sir Edward Hamley's pen. But I must draw attention to those salient points which remind us that the descent was a combined operation.

First as to time; it was a couple of months you may recollect after

the orders were given, before the flotilla was ready to leave Varna. The fleet was in sight of the coast on the 9th of September, but the landing did not begin till the morning of the 14th. It was checked on the afternoon of that day by the rising surf, and some 26,000 British infantry, with only half its artillery, no cavalry, no tents, baggage, or transport, and only 3 days' rations, were absolutely cut off from the fleet for some 24 hours (Sir William Mends says 48). Though communication was restored through the surf moderating, the result of the surf was that the army was not ready to march till the 19th.

The British fleet was composed of 10 sail of the line, 2 of them steamers; 4 frigates, 1 being a steamer; 11 steam sloops; 24 steam and 64 sailing transports. There were besides 7 steam tugs. The troops were 33,452 men, 54 guns, and 3349 horses. The boats found available for landing were 326 of the ordinary sort, and 24 special horse and gun-flats.

The boats, mostly towed by the steam tugs, appear to have made four or five trips the first day. The arrangement was that they should carry 6400 infantry, 12 guns, 216 artillery horses, and all the horses of the staff. As there was no sign of opposition, there need not have been afloat, any preparation against it, but I believe boats with guns were prepared to take their part, had opposition shown itself.

The history of the French and Turkish portions of the expedition was nearly the same as that of our own. On the first day the French landed 3 divisions of infantry and 18 guns. They were then cut off as we were. The Turks did so much better, as they carried their tents with them and were comfortably sheltered, while our poor fellows lay for a night in the open, drenched in a deluge of rain.

It is to be observed that had the march to the Alma been opposed, the army might always have had its right flank covered by the guns of the fleet, and those guns, it will be remembered, took a not insignificant part in clearing away the Russian left at the battle, and facilitating the advance of the French.

In all but one respect, the landing and progress of the Congressists in Chili last August, was on parallel lines with the invasion of the Crimea. The one difference was that the landing was on a sheltered and not on an exposed beach, and that the anchorage was a smooth-water one.

I doubt if any of our present accounts can be trusted for details, but the main features appear to be these. As in all the other landings described, there was no possibility of interference from the sea, and time was not an element of success.

On the morning of the 20th of August, the whole of the Congressist war fleet, except the *Huascar*, arrived and anchored in the bay of Quintero, having under convoy 12 transports carrying 8000 or 10,000 men with, it is said, 3 batteries of artillery and 600 cavalry.

The bay of Quintero is seventeen or eighteen miles north of Valpa-

raiso, the objective of the attack. It is sheltered from all winds except those from the northwest, and even from those, parts of the anchorage and beaches are sheltered. In August, southerly winds only could be expected, so there was no uncertainty about the landing.

This is said to have begun at 8 A. M. and to have finished at 4 P. M., there being added to the force 1000 seamen and 12 machine guns. There is no reason to doubt that such a landing could be effected in the time, because most probably the beaches were absolutely without surf.

The army appears to have marched that evening, and to have found itself ranged along the north side of the Aconagua at daylight next morning and in face of Balmaceda's army ranged along the south side.

The battle that followed was in some respects not unlike the battle of the Alma, but owing to the action of the Congressist *Esmeralda* and perhaps of other ships, Balmaceda's left wing was thrown back, and the Congressist right wing crossed the river almost unopposed. Then the left wing pushed on and the field was won.

I think you will agree with me after this historical review, that my contentions are not ill-supported. You will note that in the three or four typical cases of direct attack, there was always a choice, and that in every case the direct attack failed, and the indirect, where the navy withdrew into the background, succeeded.

There are no doubt a few cases on the other side, but the capture of Gibraltar, which might readily occur to one's mind as opposing, is really a most confirming case. The land forces here took up the blockade, and the sea forces made the direct attack. But this was simply because Gibraltar reversed the topographical conditions, and stands almost alone as a place impregnable, except to direct sea attack. We might even go farther and say that it is this peculiarity which has left it in our hands, though it had to rely for a year at a time on its own strength.

You can then see the almost invariable search for smooth-water bases of operations. From Minorca to the Crimea, if they were not sought at first, they were sought at last, and the Congressists a few months ago followed the example of Peppernel and Warren, in 1745.

It is certainly a curious subject for reflection, that out of all the great operations, the descent on the Crimea is the only one which, with smooth-water anchorages and landing places available in Kamiesch, Kazatch, and Balaklava harbors, the risks of an exposed beach were faced.

Here was a combined operation in which the rule of war seems to have been deliberately broken. Sir Edward Hamley, in his recent book, cannot avoid dropping a hint on the anomaly. We know that before the landing, there was a note sounded against it by officers of the French army, but the information given to us of that note is not explicit. Were the French aware that we were about to act contrary to rule, and had we forgotten the experiences of our history?

It is impossible to look back on the story of the landing and its im-

mediate results without thankfulness that we had an enemy who was not very enterprising.

It is often pointed out that, though the Russian army was only some 13 miles off, and though our troops were cut off from the fleet for many hours, yet the situation was not a dangerous one the first night of the landing. The two armies were landed on two strips of beach, having their rears covered by two salt-water lakes. But they were separated by a mile or a mile-and-a-half of high ground, and some of our troops at least forsook the cover of the lakes and occupied the high ground. It sometimes strikes me that a Russian advance on that high ground during the hours of darkness, when the guns of the fleet would have been of no avail, might have had the most serious results.

And, on looking back, we cannot doubt on the danger of the flank march, and the want of a secure sea base, which was not attained till we had possession of the anchorages before named.

Perhaps the Crimean beach was the most open that a hostile army ever landed on. The beach at Aboukir was sheltered from most winds; that at Algiers had a choice of shelters according to the wind; that at Quintero Bay was well sheltered. But in spite of partial shelters, it is remarkable that landings on beaches have almost always been delayed by the perverseness of the sea. We have seen how, after the ships arrived in Gabarus Bay, the surf made a delay of five days before the landing could be effected, and then the loss of boats and men in the surf was heavy. Abercrombie's landing was also delayed five days by the sea, and we paid for the delay in loss on landing, because it gave time to the enemy to intrench himself to oppose us. The landing in Algiers was delayed from the 25th of May to the 14th of June—20 days—while the landing in the Crimea was absolutely stopped when half done, and afterwards delayed so that the landing begun at daylight on the 14th of September was not complete till the evening of the 18th.

Everything we know, in short, tells us to regard landing on beaches as a hazard not to be undertaken if it can possibly be avoided.

But whether the landing-place be protected or unprotected from the sea, the advance to the shore may always be more or less strongly opposed by the enemy, unless he is driven off by the covering ships. Abercrombie's landing—apart, of course, from those which have been attempted in the face of strong works—seems almost the only one which has been seriously opposed. I suppose that an army in the open, or with only field-works to strengthen it, cannot face the fire of a proper proportion of war-ships. I take it that in any completely arranged combined operation of this sort, the navy can be used—and should be used—to compel an unopposed landing.

But I think that the modern steam pinnace gives certain advantages to the invaders as against defenders. Formerly, as at Aboukir, the approach to the beach was made by the boats in what we call "line abreast." The speed of approach was only what oars could give to

deeply laden boats. There was a certain difficulty in arming many boats with guns so as to screen the approach. Now the advance wonld be made in many columns in what we call "line-ahead," each column would be rapidly towed by a steam pinnace, in the bows of which would be a quick-firing gun. Sometimes I think that a line of columns so approaching could not be resisted but by much superior force on shore.

The steam pinnaces could never touch the shore, and, therefore, every boat loaded with troops must have its full crew of seamen as aforetime. But these men would come to the few strokes of their oars necessary to carry the boats to land, in a state of vigor; such was denied to the seamen of Lord Keith's fleet at Aboukir.

But after all is said and done, I remain in the belief that these stirring, romantic, and glorious phases of the combined operation must not be looked for as becoming common. If the sheltered port is the base aimed at, steam has given us wonderfully increased powers of obtaining the object with speed. I know only of the fear of submarine mines as a bar to these advantages. But modern processes for the discovery and destruction of these mines are so perfected that the delays cannot often be long. And thus we come back in the end to the prosaic, but exceedingly business-like proceeding of our forefathers, where the navy scarcely fired a shot or received one, and only put forward the army in a position to do work which it is sure to do well.

It is the last appointed part of my task to offer you some remarks on the embarkation of troops in the presence of an enemy.

Historically, we have very little experience of this operation, but this seems to cry aloud to us to avoid it at all hazards. We had an early warning of the dangers of such a retreat in 1694. In this case, Lord Berkley the admiral, and Talmash the general with 6000 troops concerted landing in Camaret Bay, just south of the entrance into Brest. The object was the ultimate capture of Brest, but the mistake was an attempt to land at a point thoroughly well defended. The fire of the heavy ships was not considered available, or perhaps things might have been different. As it was, the general landed with an advanced guard of 900 men, these were driven back upon their boats, and 600 of them, including the general, were put *hors de combat* in the attempt to reëmbark. The covering vessels were few and were terribly shattered, while there was a great loss of boats.

The embarkation at Corunna in 1809 was not, as is sometimes casually said, in the presence of the enemy. Soult had been beaten, and had retired before the embarkation began, and it was conducted precisely as it would have been had no enemy been near.

Almost the only other notable instance of this operation was the retreat from the Taku Forts in 1859. As to this, I believe it may be said that but for darkness, there would have been none of the gallant men who landed, left to embark. I doubt if at any period of our history, survivors of a disaster had a narrower escape.

But though any teaching from history thus eludes us, we can see that there are one or two certain and salient points to be considered. If sufficient war-ships are present, and their fire is available, it should easily prevent loss in embarking. But the difficulty must be that it can be seldom available. If the ground over which the troops are retreating is at all flat, and if the enemy presses them closely, the ships cannot fire without danger to their own men. And this state of things must then continue down to the embarking place itself. There seems to be no way of affording cover to the retreating force, unless it should retreat in columns well apart, so that boats carrying guns might fire through the intervals upon the pursuing enemy. If the ground is high and sloping down to the embarking place, the enemy's advance may probably be checked by fire over the heads of the retreating forces. But after any review of this operation considered as a continued one, I fear that the verdict must be that the navy, as such, cannot give much help.

Before I conclude, I should say just a word on combined defense. History says this to us pretty plainly: if the navy can defend at all, its defense is complete. If it cannot completely defend, so as to forbid attack altogether, it seems to grow powerless as a distinct service, and it merges such powers as it has, in the military defense. A naval force put on the defensive at a port, for instance, withdraws into the harbor; moors its ships in fixed positions as parts of the regular defenses, or lands its guns and men to be wholly incorporated with the army.

If you ask me whether history is to repeat itself in this respect, I am bound to offer you an opinion that it will. Submarine mines, in the hands of the defenders, may make doubly sure, that which was sure before, namely, the unlikelihood of direct attack from the sea. But this only increases the certainty of the attack by land. The navy, in such a case, may use torpedo boats and other vessels at disposal for the annoyance of the blockading and supporting fleet, but this body, not being the attacking force, its annoyance will hardly hinder the progress of the land attack.

I think, however, that steam has made our protecting naval force much more protective than it used to be, and hence, until it is beaten, the army and the navy are not likely to be combined for purposes of defense.

I have endeavored to give you a comprehensive survey of the field opened to me by the title of my lecture. I have been very conscious of the difficulty of the question, and I have not spared my time in examining it for you. However short I have come in my treatment of it, I am sure you will see what a wide one it is, and will agree with me in congratulating the Council on their choice of the matter, however little you may be able to congratulate them on their choice of an exponent.

Military Notes.

THE FORTIFICATIONS OF MANILA.

IT is always the unexpected that happens. In November, 1896, a Spanish periodical, *La Ilustracion Española y Americana*, in an article about the capital of the Philippines, made the following statement: "Even the strongest army would fail to capture Manila from the land, but the city has no protection of any importance against modern men-of-war." Manila has been exposed to the attacks of insurgents, and apparently her fortifications have proved adequate to repel such aggressions. But the Spaniards did not consider until quite recently the possibility of an attack by a hostile fleet, and the hasty preparations made when such a contingency arose were not sufficient to remedy the inferiority of these fortifications.

Manila is an old city, founded in 1571 by Miguel Lopez de Legazpi, and is admirably situated on the shores of a spacious bay which could easily accommodate all the European and American squadrons. A wide river, the Pasig, empties into the bay at Manila. Three bridges cross the river; the largest "Puente de España" (Bridge of Spain), marks the end of a small inner harbor. As this harbor, however, affords little shelter from the monsoons, many vessels, especially those of considerable draught, seek anchorage in the harbor of Cavité, three hours to the southwest of Manila. At this point, the arsenal, together with the fort of San Felipe and the bastion Guadalupe afford defenses which the battle of May 1, 1898, proved to be powerless against a modern fleet.

Part of the city of Manila is inclosed within a wall more than two miles long, and this part seen from the sea presents the appearance of an ancient fortress, with moats and drawbridges. Within this wall are located various government buildings, the cathedral, the palace of the archbishop and many convents. The city has many fortifications, the most important of which is the citadel or fort of Santiago commanding the walled part of the city and the mouth of the Pasig River.

Manila, however, is not by any means chiefly a military city; in fact, it would appear that fortifications were erected mainly as a protection against an attack by insurgents. As a commercial centre, Manila is very important, and will probably equal or even surpass Hong-Kong when it comes definitely under some other domination than the Spanish. The city now has about 200,000 inhabitants and is by far the largest city in the Philippines. The French navigator La Pérouse, who visited Manila in the eighteenth century, considered it "the best situated city

in the world." Some parts of the city, particularly along the seashore and along the banks of the Pasig, are quite modern in construction. At the outskirts are found the palaces of the rich Philippine families, large and beautiful hotels and the summer residence of the Captain General of the Philippine Islands. The suburb of Binondo is the business part of the city. The small proportion of business in Spanish hands is remarkable; German and British merchants have the most important establishments.

The Philippine Islands occupy a prominent position in the far East; there are 2000 islands, upon the largest of which, Luzon, is situated the capital, Manila. The foreign element in this city is very numerous, Chinamen being very strongly represented; about 100,000 of them are said to reside there. Foreign interests in the Philippines are manifold; the protection of trade and shipping is essential to the interests of Germany and Great Britain. Great Britain besides, owing to the proximity of Hong-Kong, would have a strong political interest in the Philippines. The French possessions of Tonkin and Annam are even nearer than Hong-Kong, and the ease with which Manila might be converted into a first-class fortress will undoubtedly be an incentive to opposition in case any European nation should gain control of the Philippines. It is stated coal is found on the islands in large quantities, and if this is correct, the value of Manila as a naval base would be further increased. The future development of the Philippines will be watched with interest by the entire civilized world, and it can hardly be doubted that the present war will bring about a change in the government of these islands favorable alike to natives and foreigners. Here, as before in Japan and China, the meeting of European and American civilization will, it is to be hoped, reclaim a people which for centuries has been kept out of contact with the progress of the world.—*Scientific American Supplement.*

RIGHTS AND DUTIES OF BELLIGERENTS AND NEUTRALS.

At the Royal United Service Institution, on May 19, Mr. J. Macdonell, LL.D., Master of the Supreme Court, delivered a lecture on "Recent Changes in the Rights and Duties of Belligerents and Neutrals according to International Law."

Mr. Macdonell said that when he arranged with the secretary, about six weeks ago, respecting his lecture he did not anticipate that the subject would have the living interest which it now possessed. He proceeded to point out how international law was in a state of rapid transition, and that much that was taught in books on the subject had become obsolete. Among the great changes affecting international law were the decline in the belief in a "law of nature" and in the influence of Roman law; the doctrine of the equality of States was also no longer accepted as it once was; international law was now based on a community of civilization, and another great change was the growth of "mil-

itary realism "—a spirit which found eloquent expression in much of the military literature of Germany. In dealing with the chief recent changes which had taken place in international law, he took as the starting point the close of the Crimean War. In 1856 the Great Powers issued the Declaration of Paris, of which the history was still shrouded in some mystery. Neither Lord Clarendon nor Lord Cowley, the diplomatists more directly concerned, gave a full account of the negotiations; the only detached statement was one published by M. Drouyn de Lhuys, who was French Foreign Minister at the time. According to that statement—it was borne out by the remarks which fell from Lord Clarendon—that declaration would have been made by the bulk of civilized States whether we had acceded to it or not. Referring to the abolition of privateering, he remarked that perhaps the growing sense of humanity and the recollection of the squalid abuses connected with privateering had something to do with its disuse. But much was due to this fact—the transformation of a merchant vessel into an efficient cruiser was not so easy as it was in the days of Paul Jones or Jean Bart. When that transformation was practicable there was little in the Declaration of Paris to prevent it. Article 2 provided that "the neutral flag covers enemies' goods, with the exception of contraband of war." This closed a long controversy, in which England had on the whole consistently maintained her right to seize an enemy's goods wherever found. It was not clear that we could have prevented a general affirmation by the civilized world of the principle "free ships make free goods." It was not clear that we could have maintained our ancient principle without provoking the hostility of neutral nations, and it was still less clear that we could now rescind what we did in 1856. One could not lose sight of the fact that exemption from capture on sea was probably for a long time to come out of the question. Such exemption would be in war to the supreme advantage of England, which stood to lose so much. The Declaration of Paris did not deal with contraband of war, and he could not say that as to this in recent years, either here or elsewhere, there had been any distinct change. No prize courts had for many years sat in this country. When they went to war they would see them applying doctrines and principles of a startling character, and highly unfavorable to neutrals—doctrines and principles formed at a time when belligerents were a law unto themselves. Members of Parliament had lately asked the government again and again whether they intended to prohibit the exportation of contraband. The crown had power under the Customs Act, 1879, to prohibit the exportation of certain kinds of contraband—a power, however, which was rarely exercised. A vessel might be contraband, and the fitting of it out might also be an infringement of the Foreign Enlistment Act, but, speaking generally, there was no power to prohibit the exportation of contraband; the risk of capture was the only penalty. The Foreign Enlistment Act of 1870 made our neutrality law more rigorous than that of any other country. It was the outcome

of the complaints of the United States Government as to the defects of our neutrality law in allowing the escape of the *Alabama*. The English act of 1819 was based on the American statute of 1818, but was in several respects more stringent, and, as he had said, the statute of 1870 still further increased the stringency of English law. But no change of any kind was made in the United States statute. The consequence was that many things punishable here were not so according to American law, and they were not punishable under most other systems. As they were all aware, too, our government undertook by the treaty of Washington of 1871 to observe in the future three rules then formulated, and to bring them to the notice of other countries. No other nation had adopted these rules, which many jurists treated as unreasonably onerous to neutrals. He was inclined to think that the act of 1870 and the rules of 1871, properly understood, did not go beyond what was reasonable; but it was more heroic than prudent to admit the existence of these duties without insisting on or asking for reciprocity or giving some explanation of the sense in which we understood them. The only occasion on which these rules were construed—at the Geneva arbitration—they received an interpretation which every English lawyer repudiated. In recent wars in which maritime operations had been carried on on a large scale, the chief controversies had turned on the duties of neutrals to belligerents. The events of the last few weeks suggested several desirable modifications in the interests of neutrals. A neutral must be prepared to put up with many inconveniences from operations conducive to the termination of war, but it was plain that the present laws of war permitted of acts which might profoundly injure the neutral without, perhaps, greatly aiding the belligerents or conducing to the close of hostilities. Recalling the effect on the price of wheat here and elsewhere, the far-spreading consequences of the rise caused by vague alarms of capture, let them conceive what would follow from a blockade, maintained even for a few weeks, of the chief American ports. Suppose that in a war between Germany and Russia the ports of the latter were sealed, and that no wheat from Russia was procurable at a time when harvests in America and other countries usually supplying us with wheat were bad, should all neutrals consent to starve in order that the ring might be kept for the combatants and the game of war be played out in the good old way? For the common benefit of civilization, the maintenance and use of certain machinery, plant, and services were necessary. The treatment of submarine cables in time of war was a still more difficult and important question, and one as to which international law had so far failed to give any clear guidance. No one could say with confidence what would be its development as to this point. An international convention was entered into at Paris on March 14, 1884, for the protection of telegraphic communication by means of submarine cables; but Article 15 expressly stated that the convention was not to interfere with belligerent rights. Probably effectual safety against the danger

here referred to was to be found in the multiplication of lines of communication; but pending extensive developments of telegraphic enterprise it was hard to contemplate calmly the possibility of England's being cut off from India or some of her colonies, not by her enemies, but by a State professing to be friendly to her, in order to injure some other State. It seemed to him that in any satisfactory convention there should be an article binding the signatories not to cut or injure cables connecting countries with their colonies or dependencies. That the strict enforcement of belligerents' rights as laid down in the text-books would be here ruinous to neutrals, that the new maritime law, slowly disengaging itself from precedents and traditions, must here, as elsewhere, take greater notice of the interests of neutrals—that was the reflection with which he ended.—*United Service Gazette.*

THE INFANTRY SWORD.

The subject of infantry officers' swords is discussed in a letter appearing in a recent number of the *The Pioneer.* The writer adverts to it as follows:

This is a subject which has been very freely discussed by officers serving on the recent frontier operations, and the sword has been universally condemned by all infantry men having to wear one. Its disadvantages are: (1) that as a weapon either of offense or defense against an enemy armed with fire-arms, it may be considered to be practically useless to an officer on foot; (2) it is a great impediment when moving over rough or mountainous ground, when the sword and scabbard almost invariably have to be withdrawn from the sling of the Sam Brown belt and carried in the hand, which when any climbing has to be done and both hands, or a khud stick are required, becomes most awkward and very much in the way; (3) the carrying of a sword so distinguishes an officer that he becomes an easy and certain mark for the enemy's riflemen, and many officers during the late operations undoubtedly owed their death and wounds to the wearing of a sword; (4) not one infantry officer in one thousand has, or ever will have, the remotest idea of using his sword scientifically, and even if he did know, such knowledge may be held to be of no more use to him for purposes of war than a knowledge of boxing, cricket, or any other manly exercise would be. It seems pretty evident therefore that the sword as a suitable and reliable weapon for an infantry officer, may by all practical men be regarded as obsolete, and what it becomes the authorities to do, is to arm their officers with a more suitable and up-to-date weapon as soon as possible. The revolver also does not commend itself much as an ideal weapon, as it is difficult to shoot straight with at any distance beyond about 20 yards. There is no doubt too that revolvers will be shortly entirely superseded by magazine pistols, which have no recoil and are more accurate and longer ranging weapons. In fact, from accounts received, the Mauser and Bergman magazine pistols are far ahead in every respect of revolvers, and no

doubt will be largely used as soon as they become more generally known. The right form of weapon for an infantry officer would, however, to my mind, be a light magazine carbine of about six pounds weight, which should take the place of both sword and revolver. It should be provided with a sword bayonet for the possibility of close quarters, and when not in use would be carried slung over the back. Such a weapon could be made most accurate and effective up to medium ranges, and could be made light enough to weigh about the same as the sword and revolver now carried. The Mannlicher carbine at present appears to approximate most to the required weapon, though it is a little too heavy and powerful, but our gunmakers at home could no doubt turn out a lighter magazine weapon of the right weight, and firing with extreme accuracy up to 500 yards, were such an arm demanded. The introduction of a new sword, and the attempt made a year or two ago to revive swordmanship amongst infantry officers has proved a miserable failure, as no ordinary man can ever be induced to believe that his sword will ever be of any use to him beyond that of marking his rank. I pen the above remarks with reference to infantry officers only, and hope this subject may be regarded from a dispassionate and common-sense point of view, as it appears to me that in a few years the sword will become almost as obsolete as the bow and arrow.

ACCLIMATIZATION IN THE TROPICS.

The question of the white man's ability to conquer the tropics and to make for himself a permanent home in those delightful regions is one that has hitherto possessed a purely academic interest for physicians in this country, but the fortunes of war and projects of annexation are making it probable that this will soon be changed. Porto Rico, the Sandwich Islands, and the Philippines are all tropical islands, and if they, one or all, come under our flag, doubtless many of our citizens will go thither to seek their fortunes, and the question of acclimatization will at once become a most practical one.

We find, in the *British Medical Journal* of April 30th, an interesting account of what is therefore for us a most timely discussion on this topic. The discussion took place in the rooms of the Royal Geographical Society, in the presence of many of the best-known authorities on tropical pathology. Most of those taking part in the debate held that there is no reason whatever why the white man should not be able to adapt himself to the new conditions of life in the tropics and protect himself against the diseases that prevail in those regions. The popular belief that the white man cannot successfully colonize the tropics is disproved by the fact that he has done so. It is undoubtedly true that many northerners who go to equatorial regions contract disease there and die, but in the majority of such cases the man is the victim of his obstinate unwillingness to change his habits in respect to eating, drinking, and clothing, and to conform his mode of life to the new conditions.

The chief diseases, both acute and chronic, of tropical countries—those which formerly caused such ravages among the white settlers and gave rise to the prevalent theory that Europeans could live only in the temperate zone—are all microbic in origin and consequently preventable in great measure. We cannot, of course, expect to see them absolutely wiped out of existence, at least this side of the sanitary millenium; but their sting, like that of small-pox, can be extracted by means of an improved public and private hygiene and other prophylactic measures. A comparison of the healthfulness of the West India Islands under enlightened British rule with that of the two until recently under Spanish misrule shows what can be done by sanitation to convert a pest hole into a paradise. Indeed, as Dr. L. Sambon, in opening the discussion above referred to, well said, sanitation has within the last few decades wrought wonderful changes in all tropical countries, as regards health conditions, and the changes have been so great in some places that regions which were once considered most deadly are now even recommended as health resorts.

Dr. Patrick Manson, than whom there is no greater authority on the pathology of equatorial regions, began his remarks with the confession that in former years, under the influence of early teaching, he shared in the pessimistic opinions then current about tropical colonization by the white races. In recent years, however, his views on this subject had undergone a complete revolution—a revolution that began with the establishment of the germ theory of disease. He now firmly believed in the possibility of tropical colonization by the white races. Heat and moisture, he contended, were not in themselves the direct cause of any important tropical disease. The direct causes of ninety-nine per cent. of these diseases are germs. When these germs and their habits are known fully, victory will be within man's grasp. Most micro-parasites, when they are once within the body are fairly safe. But these same parasites, in order that their respective species may keep in existence by spreading from one host to another, must at some time or another leave the human body, and during this necessary extra-corporeal state they are eminently vulnerable. To kill them then is simply a matter of knowledge and the application of this knowledge—that is to say, sanitary science and sanitation.

One earnest contention of those who argue against the possibility of successful colonization of the tropics by the white races is that, even if the original colonist lives out his natural term of years, his children will bear in themselves evidences of the degenerative influences of a hot climate. It is true, indeed, as was admitted by Sir Harry Johnston, that in many parts of the tropics the climate does cause a deterioration of European races. As an example of this is cited the offspring of British parents in India, who, if brought up in that country, do not reach the standard of stamina seen in the home-bred Briton. This is no doubt true of other places than India and also of other than tropical regions, but it

is not true of all tropical countries. It is a question whether it is the heat alone that works this change, or whether there are certain as yet unappreciated telluric influences which are responsible for the loss in stamina. In India, Ceylon, tropical America, and Australia, the problem of colonization may be regarded, to quote Sir Harry Johnston again, as solved. In other regions certain definite diseases still stand in the way—namely, malaria, dysentery, and yellow fever in the West Indies, and blackwater fever or hæmoglobinuria in Central Africa. Even for malaria quinine is by many regarded as a not absolutely sure prophylactic; and for the other diseases there is none as yet. The real question of colonization of the tropics lies in the finding of means of protecting Europeans against the diseases named. That this means will some day, if not very speedily, be found, can hardly be doubted by any but the most confirmed sanitary and therapeutic pessimist.—*Medical Record.*

VICKERS' GUNS.

Messrs. Vickers, Sons & Maxim, Limited, manufacture every type of ordnance, their plant being capable of dealing with guns of over 100 tons weight, but the demands of the artillerist are now confined within the limits marked by the 50-ton gun, hurling an 850-pound projectile from the muzzle with a velocity of 2750 feet per second, and the automatic gun firing as many as 800 shots per minute. The large breech-loaders for use in battle-ships include 12-inch, 10-inch and 9.2-inch calibre guns, while the quick-firers are 8-inch, 6-inch, 4.7-inch, 4-inch and 3-inch weapons, with many Maxim and machine-guns. The method of constructing most of the larger guns is known generally as the steel and wire-wound system.

An interesting feature of all the guns is the breech plug, originally invented by a Swedish engineer (Mr. Axel Welin). It is made in segmental portions in steps of varying radii, as will be readily seen from Fig. 2. By this arrangement a plug divided, say, into eight segments would have six segments, or three-fourths of its circumference, threaded for meeting the strains on the breech; while the ordinary parallel breech plug, with thread and plane surface alternating, has only half its circumference threaded, the other half being useless for resisting the back pressure in firing. This enables the plug to be shortened by one-third of its length, and proportionately lessens the weight. The reduction is of great importance, as the gun is shortened at its heaviest part, which means considerable reduction in its weight. The breech plug, too, can be more easily swung clear of the breech after unlocking, without any curvature, and without the usual longitudinal withdrawal. This can even be done with the De Bange obturator.

The breech mechanism for the 12-inch, 10-inch and 9.2-inch guns is fitted with the necessary gear to enable it to be worked by hydraulic or other power; it is applicable to any gun of smaller or larger calibre and

is suitable for either a right- or left-hand gun. The mechanism is so arranged that by turning the hand wheel the breech plug is first rotated and unlocked, then drawn longitudinally to the rear until the obturating pad is clear of its seat and finally swung out of the breech of the gun. The horizontal sliding bar mounted in the carrier has one end connected by a roller stud to the arm which is fixed to the hinge bolt of the carrier. On the top of the sliding bar are formed teeth into which is geared a pinion, pivoted in the recess in the carrier. This pinion is keyed to the shaft on which is fixed the actuating lever. Projecting from the actuating lever is the roller stud which works in a slot in the rear face of the breech plug to rotate it. On the stem of the carrier, on which the breech plug is carried, there is fitted, with freedom to turn, the sleeve with a forked arm projecting from it. On the outer circumference of the sleeve are three inclined grooves of increasing pitch. Three roller studs, mounted on a ring fitted into the bore of the breech plug, work in the inclined grooves of the sleeve in such a manner that a longitudinal movement is given to the breech plug, when the sleeve is turned by a roller stud, which projects inwardly from the face of the horizontal sliding bar, and works in the forked arm of the sleeve. A worm and worm wheel operated by a hand wheel are carried in a suitable position at the breech of the gun, and when rotated, cause the movement of the actuating arm.

To open the breech the hand wheel is rotated, and thus, by means of the worm wheel, the actuating arm is moved, causing the sliding bar to move horizontally. This revolves the pinion and the actuating lever, which in turn rotates the breech plug, at first slowly, and then more rapidly, until it becomes unlocked. The sleeve, which is held in position until the plug becomes unlocked, by means of a projecting pin working in a groove in the face of the sliding bar, is now free to turn, and by continuing to move the sliding bar the projecting roller stnd engages the forked arm of the sleeve and so turns it. The rotation of the sleeve causes the plug to move longitudinally rearward by means of the projecting studs working in the inclined grooves of the sleeve. After the plug is drawn longitudinally rearward, the continued movement of the actuating arm swings the mechanism out of the breech of the gun.

The gun is arranged for firing by electric or percussion tubes, and its action is similar to that of our 6-inch quick-firing gun. Provision is made so that the mechanism can be worked by hydraulic gear. Suitable clutches are provided, so that the change from hand to hydraulic gear, or *vice versa*, can be easily and rapidly effected by the rotation of a small hand wheel.

With a charge of 207 pounds of cordite, and using 850 pound shot, a muzzle velocity of 2750 feet per second and a muzzle energy of 44,573 foot-tons can be obtained with this very serviceable 12-inch 50-ton gun, for which Messrs. Vickers, Sons & Maxim, Limited, have an admirable type of mounting for use within barbettes, whereby the gun can be rap-

FIG. 1.

idly worked in action, giving considerable rapidity of fire, without introducing any delicate or complicated mechanism.

The 8-inch and 6-inch quick-firing obturating gun of 45 calibres, the latter of which is illustrated in Figs. 1 and 2, are equally remarkable in respect of the simplicity of their mechanism and the high energy developed. The guns are of steel and wire construction; and the total length from the breech face to the muzzle is 31 feet in the case of the 8-inch, 23 feet 3 inches in the 6-inch weapon. The 8-inch gun with a charge of 52 pounds of cordite, and using 210-pound projectile, attains a muzzle velocity of 2750 feet per second and a muzzle energy of 11,012 foot-tons. With 25 pounds of cordite for a charge, and using 100-pound shot, a muzzle velocity of 2775 feet per second and a muzzle energy of 5340 foot-tons has been obtained with the 6-inch gun. The breech mechanism is also illustrated, the view showing the breech open.

The breech plug is opened or closed by the horizontal movement of a hand lever. The same action rotates, locks or unlocks the plug, swings it in or out of the gun

around the pivot on which it is mounted, and causes the percussion and electric striker to make or break contact at the required positions during the working of the mechanism. The arrangement consists of a link, one end of which is so pivoted on a pin projecting from the rear face of the breech plug that the link works in a plane parallel to the breech face of the gun; while the other end is pivoted to a short crank mounted on the plug carrier, and around the boss of this crank are formed "skew gear" teeth. The hand lever for actuating the breech mechanism is pivoted on the plug carrier, and moves in a plane at right angles to the breech face of the gun. Around the boss of the hand lever is fitted a skew gear wheel, which gears with the skew teeth formed on the boss of the crank.

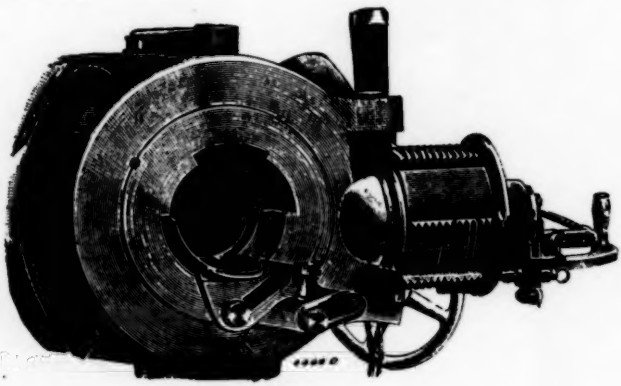


FIG. 2.

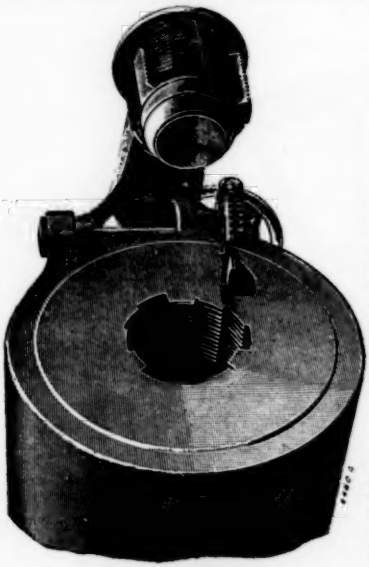
The whole is arranged and proportioned in such a manner that when the breech is closed the hand lever lies close up to the breech face ol the gun. The arrangement of centres and pivots, together with the relative lengths of the link and crank, provides great power when opening or closing the breech.

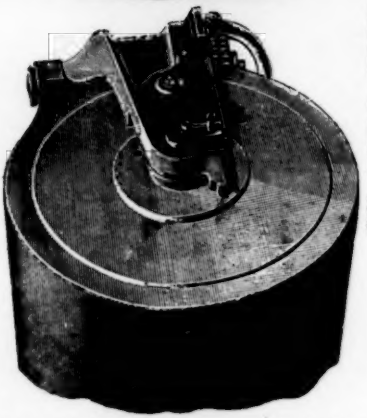
On swinging the hand lever away from the gun, so as to open the breech, the crank moves the link past the locking centre a short distance, without causing any perceptible movement of the plug. The further movement of the hand lever causes the crank to turn, and by means of the link rotates the plug, at first very slowly (thus obtaining great power), and then more rapidly, until it becomes unscrewed. The carrier then moves with the lever, swinging the plug clear of the gun.

A loading tray is provided, which is automatically moved across the breech face and raised into the loading position when the breech is being opened, and lowered when it is closing. The firing gear is arranged for firing by electric or percussion tubes, and is operated by the movement of the hand lever and link. It is so arranged that the first movement of

FIG. 3. 3-INCH FIELD GUN.

the hand lever, when unlocking the breech, acts on the firing gear and makes the gun absolutely safe before the breech plug commences to unscrew. By the continued movement of the link the empty tube or primer is automatically ejected. The form of breech mechanism described, which is a patent of the company, embodies several marked improvements over existing designs. There is a considerable reduction in number of parts. The mechanism is quickly and easily taken to pieces, while the accessibility of the parts is a great feature. The lever which opens and closes the breech by a horizontal movement occupies a very small horizontal area, so that the mechanism is easily worked in a restricted space. An improved and strengthened form of loading tray has been introduced, whereby existing difficulties as regards the tilting of the shot are entirely overcome.





FIGS. 4 AND 5. BREECH MECHANISM OF VICKERS' 12-INCH GUN.

The casemate mounting for these two quick-firing guns only differs in slight details. It consists of a steel top carriage resting on balls running on ball bearings on a steel pivot. The cradle in which the gun slides is a cylinder; attached to the cradle are three cylinders, one to overcome the recoil and the other two (one on each side of the recoil cylinder) contain the springs for running the gun up to the firing position after the recoil. The connection between these three cylinders of the gun is made by arms projecting from the breech ring. The whole weight of the moving parts, gun, cradle and carriage, is taken on the balls above referred to, so that the training is very easy. The elevating and training operations are performed by the rotation of two hand wheels

conveniently placed with regard to the shoulder piece against which the gunner leans. These two hand wheels are worked on the left side of the mounting, which has also an auxiliary hand wheel on the right side, so that, if necessary, two men can conveniently train the gun. The recoil cylinder is of the usual construction, being fitted with a valve key supported at both ends, the valve key being of stronger section than is usual, and the whole arrangement of fewer parts. The shield is of the usual casemate type, the pedestal being very strong, to withstand the impact of small projectiles. This type of mounting affords increased protection from shell fire by the construction of the top carriage, the front of which is of considerable thickness, while the general arrangement of the several parts, such as recoil cylinder, spring cases, elevating and training gear, is well disposed and under exceptional protection. The parts are few in number, easily kept in good repair, very little attention being necessary. The form of cradle is of strong design and completely covers in the breech end of the gun, thus preventing dirt, grit, etc., impairing the working.

The 4.7-inch quick-firing gun is also of 45 calibres, the total length from the breech face to the muzzle being 18 feet 1 inch, and with 9 pounds of cordite for a charge, and using 45-pound shot, a muzzle velocity of 2600 feet per second and a muzzle energy of 2109 foot-tons can be obtained. The breech mechanism is similar to that described for the 6-inch quick-firing gun (obturating). Sometimes a metallic case is used in place of a "De Bange" obturator, the firing and safety gear being modified to suit, and no shot tray is required.

The mounting is somewhat similar to the 6-inch quick-firing gun just described, but with this slight difference, that while the cradle in which the gun slides has a similar cylinder to overcome the recoil, there is only one cylinder for running the gun forward after recoil.

Another noteworthy weapon is the 12-pounder (3-inch) quick-firing naval gun, a favorite weapon among the auxiliary armament on all warships. The breech plug and mechanism is similar to that described for the 6-inch quick-firing gun. With 2 pounds 9 ounces of cordite for a charge, and using 12.5-pound shot, a muzzle velocity of 2700 feet per second and a muzzle energy of 632 foot-tons can be obtained. The centre pivot mounting for this 12-pounder is similar to that of the 4.7-inch gun.

The 12-pounder 3-inch quick-firing field gun (see Fig. 3) is 23.5 calibres, and the characteristic feature of the carriage is the method of taking up the recoil. All parts of the carriage are free to recoil except the hydraulic buffer, which is placed between the side cheeks of the trail. The front end of the buffer piston is attached to the front end of the carriage, and a strong spade is fixed to the rear end of the hydraulic cylinder. The cylinder is further connected to the trail by chains. Around the part of the piston rod which projects outside the hydraulic cylinder is placed a powerful spring, which is compressed at the same time as the rod is forced into the cylinder. The trail is of special form and length,

so as to slide freely back and obviate all "jump." On firing, the spade is forced into the ground, thereby arresting all movement of the cylinder rearward, but the trail, being free to move to the rear, forces the hydraulic cylinder and springs to assist in taking up the recoil, while the spring serves to run the gun forward into position again.

The gun is connected by trunnions to the top carriage, which is pivoted to the front part of the trail, so that it can be trained through an arc of 8° (*i. e.*, 4° on either side of the axis of the mounting). This permits small adjustments in laying without any movement of the trail. If required, the hydraulic buffer can be removed in about one minute; the mounting may then be used as an ordinary field carriage, and the recoil, which will then be about 7 feet, is checked by means of ordinary shoe brakes applied to the tires of the wheels. A rate of fire of 12 aimed rounds per minute may be obtained with the use of this mounting. This system affords an efficient method of absorbing the energy of recoil and returning the gun to the firing position without disturbing the laying, and without subjecting the mounting to any excessive strain, combines the advantages of a quick-firing gun with the lightest possible construction of mounting, which is due to the length of recoil and to the mass of the recoil parts.

We are indebted to London *Engineering* for the interesting engravings and text.—*Scientific American Supplement.*

THE RÖNTGEN RAYS IN WARFARE.

At a meeting of the Royal United Service Institution, Surgeon-Major W. C. Beevor, M.B., Army Medical Staff, delivered a lecture on "The Working of the Röntgen Ray in Warfare." The lecturer said that his object was to give his experience in the working of the X-ray in military surgery, and through the kindness of many official friends he would be able to give the audience the results of its employment on the recent frontier expedition in India, and then to lay before them some modifications in the construction of the appliances for generating the X-ray which had suggested themselves to him after working among the wounded on the field of battle and its adjacent hospitals. He then exhibited, by means of the magic lantern, photographs of cases from the Frontier War, which showed with the utmost clearness the importance of the use of the X-ray in the treatment of wounded men. The positions of bullets in various parts of the body were made perfectly evident in cases where it was quite impossible to localize the bullets by ordinary surgical methods. The lecturer said that it was not only possible but quite easy to have an X-ray apparatus working at the front. The cases exhibited contained indisputable proof that even in savage warfare, where the Geneva Convention was unknown, the X-ray could be brought under control, and an immensity of human suffering obviated; it was not necessary that every field hospital or bearer company should be supplied with an apparatus, as it could be readily transported from one part

to another of the field of operations He felt sure they would see what an advantage it was to be able to localize bullets and other foreign bodies, without the painful process of searching with probes, and that a threefold advantage was gained in the treatment of patients by this means—first, the absence of any pain or physical injury, from which arose the second advantage, that in cases where there had been much loss of blood or injury to bone they were enabled to ascertain the exact condition of affairs without the risk of increasing the depression of the patient by operation, and they thus gave him the best chance of reaction upon which depended his recovery. Who, indeed, had not seen on active service many a case where the vital powers had held out to their last flicker, and were probably being supported by a cheerful and magnificent heroism on the part of a brave man, where, with proper means at hand, the surgeon had been enabled to fan that last flicker into restoring flame, which he would have been powerless to accomplish without scientific aid—and who with much experience of active service had not gone through the indescribable chagrin and sorrow of witnessing the converse? Therefore he maintained that it was now the duty of every civilized nation to supply its wounded in war with an X-ray apparatus, among other surgical aids, not only at base hospitals, but close at hand, wherever they might be fighting and exposing themselves to injury in the performance of their hazardous duty. The rest of the lecture was devoted to the consideration of technical questions in connection with the appliances required for generating the X-ray.

NEW PROCESS FOR PRESERVING MEAT.

The Chemical Society of the Massachusetts Institute of Technology, composed mostly of instructors in the chemical department, have described recently a new process of preserving meats, says the English *Electrical Engineer*. The process proposed is simply to sterilize the meats by placing them for a certain number of hours close to an electric light. The actinic rays of light, not only from an electric light, but from almost any kind of light, are fatal in time to all kinds of germs, even in the bacteria of anthrax. While the meats are exposed to the light, a stream of hot air at temperatures ranging from 115° F. to 150° F. is sent up through the box in which the meats are placed to dry them. Then the thoroughly dried meats are powdered, and are thus ready for Klondike expeditions and for army and navy use.

A METHOD OF CENTRIFUGAL CASTING.

A method of centrifugal casting has been recently introduced and described by P. Huth in *Stahl und Eisen*, by which castings similar to the ordinary chilled castings can be produced in the following way: The mould is made to rotate, when a hard steel is poured in, which flies to the sides; soft steel is then poured into the hollow centre, with the result that the casting produced has a soft core and a hard face. The

author suggests many applications, among which are wagon wheels with hard rims, projectiles with hard points, gear wheels with hard teeth, jaws for ore crushers, stamp dies with hard faces, plough points, and hard surface rolls of all kinds. Although both metals are intimately combined, yet the limits between them are said to be readily recognizable.—*Scientific American Supplement.*

Comment and Criticism.

I.

"The New Carbine."

Lieut. H V. Hawkins, 4th U. S. Cavalry.

HAVING read Captain Ellis' able essay on our new carbine, and, in the following number of the JOURNAL, the criticisms by other officers of ability and experience, I have hesitated to add a criticism that my own limited experience suggests.

But it seems to me that the principal fault in the sight of our Krag-Jorgensen carbine or rifle has not been dwelt upon with sufficient force. Most of the complaint against the rear sight is that it has no wind-gauge.

All officers of the line will probably agree with Captain Ellis, but I do not think he goes far enough in his criticism. The wind-gauge is not the only thing necessary, nor is it the most important. We have all noticed that with the carbine we invariably have to aim to the left (with the infantry rifle we have to aim to the right). If there is a wind blowing across the range from the left of the firer he has to aim still farther to the left, at certain ranges several feet to the left of the target. If the wind blows from the right he sometimes aims directly at the figure or not so far to the left as he would under other conditions. Now if a wind-gauge was the only thing necessary for accurate firing, we would have discovered before this time that it was necessary to aim to the right quite as often as to the left. At ranges where the prevailing winds were from the left it would be necessary to aim to the left, and where the prevailing winds were from the right it would be necessary to aim to the right. But this is not so. We always have to aim to the left whatever be the direction of the wind unless a regular gale be blowing from the right. When there is no wind at all the same is true. It would certainly seem then that the rear sight does not allow enough for drift. This should be corrected first and then the wind gauge could be added.

I believe in having a wind-gauge, for certainly it can do no harm and it accustoms men to aim directly at the object they want to hit, but it is secondary in importance to an accurate sight; by which I mean a sight that enables and requires a man to aim, when there is no perceptible wind, directly at the object he desires to hit. It can be argued that a wind-gauge can correct for drift as well as for influences of wind, but I do not believe a wind gauge should be used for any such purpose. If on a perfectly quiet day we have to use a wind-gauge at 200 yards to correct for drift, it shows the men that the sight needs correction for every range and causes distrust. Of course by a little experience we could correct for drift ourselves, but I don't see why a sight cannot be made that corrects for drift at all ranges and be a simple arrangement also. An enlisted man understands why when a wind is blowing he has to allow for it, but when there is no appreciable wind he grows suspicious for he finds even then that he cannot aim directly at his target. And I believe that Captain Ellis is right and that

men, no matter how brave or well disciplined, will fight better and longer with a good weapon in which they have confidence than with any other.

The rear sight is supposed to correct for drift at 500 yards, but even this it does not do. The correction for ranges under 500 yards is supposed to be in excess and for ranges over 500 yards too small. This cannot be true, for as stated above we have to aim to the left at all ranges. As Captain Bruff says, each gun has its own equation and what is correct for one is not correct for another. Nevertheless, the carbines in my troop are uniform enough to necessitate aiming invariably to the left and about the same amount for each carbine. If this is true a sight which is correct for one gun will be nearly correct for all.

Now if our carbines are made to shoot accurately at target practice, where will be the disadvantage in battle?

I have used the Krag-Jorgensen carbine as a hunting rifle and, although at 200 yards on the target range I had learned how much to hold off, when I fired at game at the same distance I was utterly at sea as to where to aim. I thought on one occasion I had allowed enough for drift but I saw my shot hit a bank considerably to the right of an antelope which obligingly stood and looked at me until I had fired. And yet on this occasion not a breath of air stirred.

I say then, give us a sight which corrects for drift as nearly as possible for all ranges and all carbines, and then give us a wind-gauge, for it will do no harm and will I believe do good.

II.

"The Infantry of our Regular Army."

Captain John R. Williams, U. S. Artillery.

"Providence is on the side of the heavy battalions."—NAPOLEON.

"THE Infantry of our Regular Army," the article by Captain Evans in the May number of the JOURNAL OF THE MILITARY SERVICE INSTITUTION, should be read with close attention. In one point only does the writer's presentation of the subject seem to call for any criticism. This is the well-worn subject of the three-battalion organization for our infantry.

The venerable ten-company battalion, we have long heard, should disappear, along with the smooth-bore musket and the last vestiges of the tactics of Baron Steuben. And it is consequently argued that we must adopt instead the modern organization of 3 battalions of 4 companies.

As far as Captain Evans' article is concerned, the arguments advanced for the ideal formation of 3 battalions of 4 companies do not seem to be conclusive. In reviewing them briefly it may be noted: (1) That there was, perhaps, as much self-interest as hope of increased efficiency in the wide-spread desire of our infantry officers for the 3-battalion system. (2) Our present infantry drill needs revision, and the organization prescribed therein might be revised at the same time. (3) Our militia is not necessarily a model for imitation in all things military.*

But at least Captain Evans does not repeat the stock argument of the advo-

* It is true that our present excellent system of target practice may be traced to a militia origin. But so may other innovations, perhaps not so desirable,—the modern kindly discipline of our army, not many degrees removed from the ideal conditions prevailing on Her Majesty's Ship *Pinafore*, and the mania for giving the titles of military commanders to everyone that wears a shoulder-strap.

cates of the 3-battalion system, viz.: That it is the universally adopted organization of the great European armies. He has seen too much of modern European armies to fall into any such error as that.

In point of fact, in no European army does the 3-battalion organization exclusively prevail. There are 1-battalion, 2-battalion, 3-battalion and 4-battalion organizations in nearly every great army to-day. Nor is the battalion of four companies the only one to be found abroad. In the 1-battalion organizations, such as the rifle battalions of France and Germany, the tendency is toward a 6-company organization.

Perhaps few of our younger officers are aware that the 3-battalion system was tried at one time in our service and deliberately abandoned. It was abandoned probably for the same frank reason that now, according to Captain Evans, demands the adoption of the 3-battalion organization—the preferences of the officers of the army. At that time, in the year 1866, the officers of the army generally were heartily in favor of one battalion per regiment, because there was more promotion in it.

Before the reorganization of 1866, our infantry was composed of ten regiments of one battalion each, and nine of three battalions each. In the reorganization, each battalion became a regiment, a gain of 18 colonels and 18 lieutenant-colonels in the old regiments alone. In the minds of most of the officers of the army of that day, it is surmised, this fact was all the argument necessary for the change.

It is true that, during the Civil War, the 3-battalion regiment never had a fair chance; that is, not in the Regular army. There were some superb 3-battalion regiments in the volunteers, but tactically and practically they constituted brigades and not regiments. Their efficiency would probably have been just as great if no regimental tie had connected the battalions.

Since Captain Evans' article was written the 3-battalion organization has become an accomplished fact. But it will possibly be news to some of the readers of the JOURNAL OF THE MILITARY SERVICE INSTITUTION that the organization just adopted for our infantry merely resuscitates another venerable relic of Steuben's tactics—the battalion of 400 men. With all the variety presented by the regimental organizations of the great armies of to-day, there is substantial agreement on one point, and that is the battalion of 1000 men.

Captain Evans, it is true, nowhere advocates a paper strength of 400 men for the battalion. Indeed, he has pointed out that to maintain a field strength of 400 men the paper strength of the company should be at least 150. But our legislators have so long had dinned into their ears the advantages of the weak battalion and the weak company that they have ended by adopting, in the midst of a foreign war, an organization that gives some of the promotion so long hoped for, but that will yet be cursed as the bane of all infantry efficiency.

Adding one or two more permanent majors and two more temporary companies to each infantry regiment does not strike at the crying vices of our infantry organization—the failure to provide for the proper number of efficient squad-leaders, and the failure to provide for the regimental depot. In truth, our infantry stands in more need of a greater number of permanent corporals than it does of a greater number of permanent majors, and it needs the regimental depot more than it does the 3d battalion. The division of the regiment into three weak field battalions, without providing for a modern system of recruiting, constitutes anything but progress.

With no regimental depot, what will become of the weak battalion after a hot campaign? If under similar circumstances the battalions of our volunteers, during our Civil War, shrank to 400 or even 250 effectives, we may expect to see our battalion of 400 diminish to 150 or even 100. We thus get back to Steuben's company of 40 men or less, flexible and easily handled, no doubt, but hardly worthy of figuring as a captain's command. Captain Evans has some pertinent remarks on the absurdity of the company of fifty men. But such companies are the logical outcome of the new infantry organization, and this organization is, except in one or two particulars, the logical outcome of the long agitation that has been carried on in favor of the 3-battalion system, an agitation in which Captain Evans has joined. Let us hope that our infantry officers are pleased with the result of their efforts.

It is suspected that the regimental depot might have been realized long ago, if the infantry had chosen to work for it. The "cadres," at least as far as the officers were concerned, existed already in the two skeletonized companies. The present English organization, in this case, would naturally have been taken as a model, but such a step would have been the death-blow to the whole 3-battalion plan of reorganization.

Now let the infantry turn in and work for the regimental depot. A great deal may be learned from the English system, a system by which an army of voluntarily enlisted soldiers is maintained on a peace footing of over 200,000 men, with a reserve of discharged soldiers of over 90,000. Captain Evans has called attention to the reserve of discharged soldiers as a means of filling the ranks of the Regular army in war. Other points of the English system are the 8-company battalion of 1000 men, the regimental depot of two companies, the combination of line, militia and volunteer battalions in the same regiment. Under the Constitution, no welding of our Regular and militia organizations is possible, but it would not be impossible to create one or more volunteer battalions for each Regular regiment.

Above all, let it be remembered that "Providence is on the side of the heavy battalions."

Reviews and Exchanges.

Inquiries Into the Tactics of the Future.*

"The word is free, the deed mute, obedience blind."

THE kernel of this book is the attack of the 28th Infantry Brigade of the Prussian army on the Farmstead of Bor and the adjoining intrenched wood of Briz at the battle of Königgrätz in 1866, contrasted with the attack of the 38th Brigade on the Heights of Bruville at Mars-la-Tour in 1870.

These were the "Two Brigades" that gave the name to the original work of Captain Hoenig, extracts from which were given some time ago in the JOURNAL, which must have excited in every reader a desire for the whole and this now appears in fuller development under the title *Inquiries into the Tactics of the Future.*

Lieutenant Reichmann of the 9th Infantry is the translator, and the volume is No. 6 of the International series edited by Colonel Wagner, who furnishes a preface calling attention to the qualities of the work.

Speaking of the Franco-German War it is, the colonel says, "new and interesting to find that there was tactical deficiency on the part of some of the higher German leaders and that the lack of organization of the system of reports and messages on the battle-field left Von Moltke for some hours at Gravelotte without definite and reliable information of what was going on. * * * The wild energy of the subordinate leaders was not always productive of the best results and the troops often got completely beyond the control of their generals."

And the Colonel concludes his preface by saying "when a German critic can do full justice to a French enemy and acknowledge virtually that military lessons can be drawn from Spottsylvania as well as from Gravelotte, the American reader must necessarily be predisposed in his favor and it is confidently believed that this favorable predisposition will not in any way be impaired by the perusal of Captain Hoenig's remarkable book."

Captain Hoenig deals with the influence exercised upon tactics by the three modern factors of small calibre rifles, smokeless powder and improved artillery, with its increased range, force and low trajectory.

In the preface to the second edition of his work he notes that he has been obliged to re-write the introduction and the second part of the original edition, and to add a third part.

In the preface to the fourth edition, which is the one here considered, it is also noted that the process of elimination of old matter and the addition of new has been further continued, so that we now have:

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* *International Series. Inquiries into the Tactics of the Future. Developed from Modern Military History.* By Fritz Hoenig. Translated from the fourth German edition by Carl Reichmann, 1st Lieut. Ninth Infantry. Edited by Lieut.-Col. Arthur L. Wagner, Assistant Adjutant-General, U. S. Army. Hudson-Kimberly Publishing Co., Kansas City, Mo. W. H. Allen & Co., Limited, London.

Part 1. Military Historical Studies, mainly the examples of the *Two Brigades* already quoted.

Part 2. Pschycology and Tactics.

Part 3. Tactical Deductions.

The book is not any holiday reading—valuable books never are—but the closer it is studied the more profitable it will be found. We know very little of the difficulties which must have presented themselves to the translator but to place before the American military student the contents of such a work was certainly a most excellent thing to do.

The handling of the 28th Brigade at Bor is for the most part cited as a right method, conditioned by the circumstances then existing, while the 38th Brigade at Bruville furnishes a warning to commanders high and low of the punishment that follows neglect to observe, lead and control.

Yet even at Bor the second and third line of attack having been ordered to close on the first, "just as they were on the point of making the assault with united forces the signal 'Cavalry' resounded on all sides * * * the skirmishers rallied, the battalions formed square, but the cavalry did not come."

Only a hostile squadron, having lost its way had appeared for a moment, but getting under fire trotted back again, not before however the alarm had been sounded with results as above.

This illustrates how the best of care cannot wholly banish accident from the field of battle. The signal was evidently premature and should have been withheld pending a more definite disclosure.

The error cleared up and the skirmishers having reached their former places on open ground about 200 metres from a strongly occupied abattis, "General Von Hiller, feeling the gravity of the crisis, and aware of the difficulty of getting a *lying-down firing line forward*, rode back to the second battalion of the 17th, and gave orders to advance in double time and pass the skirmish line, thus thrusting a new impulse into the whole movement."

But the general did not content himself with giving orders. He "joined the left of the battalion and on reaching the skirmish line galloped forward, raising his sword and calling, 'with me, Skirmishers.'"

Naturally enough "the entire line rose and rushed resolutely forward, drums beating and men cheering," and the enemy's position was carried at all points at nearly the same time.

Now comes the contrast as pictured in the movement of the 38th Brigade on the heights of Bruville.

There was a preliminary address by the chaplain, of whom there appear to have been two corresponding to the faiths respectively of Luther and Leo, but it was rather the Catholic ministrant who was sufficiently inspired to give the assurance, "Attack the enemy with intrepidity and God will be with you, Amen."

The advance was intended to be partly frontal and partly in flank, but there was no combination; "the front attack failed to materialize * * * and the whole business bore the stamp of uncertainty and precipitation from the beginning." The battalions of the brigade "were defeated in detail from left to right, the right reaching the enemy's line completely exhausted, when the left had already suffered defeat."

An acting sergeant major reports to his colonel, "my platoon no longer follows me, they are lying down, I have repeatedly rushed forward, it is of no use."

He was sent back to try it again. Waving his sword and calling, Forward, he now succeeds in carrying some non-commissioned officers and men with him, "the others were lying dead or wounded on the ground as they had stood in the ranks."

The brigade employed very different formations, though the ground was of uniform character. There were "swarms of skirmishers, closed platoons, closed company columns, half battalions in column and in line."

Finally, this is pronounced to be the greatest defeat suffered during the war, and is thoroughly discussed both as to what was actually done and as to what should have been done, the affair at Bruville being the exact opposite to that at Bor in result, mainly because also such in method, recollecting that in the latter instance the command was never allowed to slip from the grasp of its leaders, division and brigade generals being active in the first line, giving their orders there in person and spurring on their troops.

In connection with this it is worth while to note what is said of the French attack following the repulse of the 38th Brigade at Bruville. "The advance was clumsy and slow. A skirmish line led in which everybody commingled, in which everybody yelled, in which there was no tactical order and which moreover halted repeatedly. A second skirmish line followed, and then came battalions in line with their eagles."

"The first skirmish line fired mostly from the hip without aiming * * * the distance between the two lines was very unequal and portions became intermingled."

This French advance was checked by a charge upon its flank of the 1st Guard Dragoons and there "arose an indescribable confusion. Both skirmish lines rushed to the rear, throwing away rifles and equipments, * * * men were firing in all directions and an irregular fire came from the closed battalions."

There were three squadrons of these dragoons and they rode through three lines of infantry, threw two into flight and the third into disorder.

The five battalions constituting the 38th Brigade moved into battle with 95 officers and 4546 men. Their loss reached 53 per cent., the greater part incurred during the retreat. The total expenditure of ammunition by the brigade is put at about 20,000 cartridges.

Their French opponents are credited with 11,925 rifles and an expenditure of 80 rounds per man, according to which 1 bullet out of 452 was effective, artillery and mitrailleuse fire not included.

Passing now to a brief consideration of Part 2—Psychology and Tactics—we can imagine the ghost of old Martin Burke wanting to know "what in * * * psychology has to do with '*Ram cartridge.*'"

But unfortunately tactics *have* become psychological more and more so, that is, "they demand on the part of all leaders a higher degree of knowledge and ability, of initiative and vigor, of insight and perseverance."

There must be on the part of the soldier a broader development, morally, physically and intellectually, if he is to meet the modern requirements.

And if this be true of the soldier it is still more imperative upon his leader in every rank.

Men are now called upon to bear heavier losses, to hold out under more destructive fire, and to endure a longer continued stress of conflict. It will be truer than ever that the victory will go to him who makes the fewest mistakes, and mistakes will exact penalties far more immediate and severe.

"It is not the amount of loss that measures the value of troops, but their behavior notwithstanding these losses." It is admitted that in the infantry attack disorder and intermingling of organizations has become the rule, but in every stage of the conflict there must still be insured sufficient control to bring out the highest fighting efficiency at each point, and that demands subordinate leadership of the first quality and plenty of it, and that is the product only of previous comprehensive and exact professional training. The matter is summed up axiomatically.

"The infantry attack is a conflict of masses of skirmishers, requiring an early and sufficient development and an opportune arrival of adequate support."

"For the advance, the attainment of position, the rush from one firing position to another, there can be but one formation and one kind of fire, an open single rank line and the fire of skirmishers."

"On open ground and with the use of modern arms closed formations are bound to collapse even at long and medium distance."

From the first the superior leaders should employ the fire action of artillery and infantry so as to gain superiority of fire, superior in amount and accuracy, that gained, the rest follows, if not gained the advance becomes impossible.

A forward movement by rushes is considered practicable only when the leaders are many, the units small, and the distances short, in order to guarantee necessary control and prevent complete exhaustion, but the caution is very significant that alternate rests and rushes rob the spirit of attack of much of its determination and dash. And Captain Hoenig adds, "this subtilizing with the terrain," in other words, too technical a study of topography with reference solely to cover, "is bound to make pedants."

There is plenty of sound sense in another remark upon peace-training, "the moral efficiency of troops is not so much the result of practical exercises as of intelligently and judiciously conducted instruction."

The wearisome iteration of the drill ground makes the least possible demand upon both officer and man, but its constant diversification by the free use of the experience, reflection and capacity that should belong to the superior is of the highest benefit to both.

"Every battle-field requires special measures, obstacles of all kinds exert their effect and cause delay, displacement and irregularities. It is the aim of the tactical training of the leaders to overcome them and to keep in the midst of decisive and unexpected conditions an open eye on the roads which lead to tactical superiority, and here is where the difference between mechanical action and a true conception of the situation, the value of personal characteristics which will ever be of the first importance will become manifest."

For it cannot be too often repeated that the men who are to win battles hereafter whether in the ranks or over them will need a finer training and a higher excellence in physical, moral and intellectual attainments, than ever before. This is the lesson taught by the more costly equipment, the greater exposure, the severer stress, and the heavier sacrifice of modern war.

Part 2d closes with words also to be remembered, "a military system that does not constitute a training school in virtue fails in its duty to the State and the uninterrupted cultivation of all the ethical qualities of the men will ultimately inure to the benefit of tactics on the battle-field. The great mass is not converted, that is not necessary. But we shall convert some, and that suffices for our purpose and is worth the labor."

As the requirements laid upon the man are larger, so the range of motive and capacity to which appeal can be made must be wider and higher. It is no longer cities that are to be sacked but states that are to be saved.

Part 3d consists of tactical deductions and remarks, beginning with the statement that in 1870 the Germans conquered through superior strategy of such preponderant weight that it secured the victory in spite of their antiquated tactics. The man at the desk seems to have made a better use of his time than the man on horseback.

On the battle-field much must be left to the initiative of the subordinate leaders. Much may be anticipated and provided for by preliminary orders establishing method and means of attack formulated upon regulations applied in peace time for instruction, but adhered to only so far as circumstances permit in war, and never to be blindly followed irrespective of the exigencies of time, place and condition as they are actually presented.

The case of General Thompson and the Wahabees is in point. The general was a very well-read man in military history, none more so, and he knew his Jomini as Moody knows his Bible. The story goes that in ordering the attack he exclaimed "Jomini, Chapter 17th—I have them." But the Wahabees unfortunately had never heard of Jomini and fought on other lines, and Thompson was wiped out.

In the attack, our author says, there must be "controlled system, and within the same beyond certain variable limits task system or horde system," by which we suppose is meant that while troops must never be permitted to get entirely out of hand, neither must they be hampered by a too close adherence to any prescribed formalities.

It is thought that "entire brigades moving in open lines led and controlled can be brought within 600 metres of the enemy. At that point when they are flung into destructive fire action, superior leading ceases and further conduct of the attack rests with the subordinate leaders, with the efficiency of the individual soldier, and in the timely employment of sufficiently strong reserves on the part of the superior leaders." The so-called task system is contrasted with brigade leading, and appears to mean the manner in which the subordinates effect so much of the job as is left to them to finish.

"Inquiring into the tactics of the future," it is laid down that movement, of columns and closed lines at all ranges are things of the past.

Within 1200 metres but one formation remains appropriate for movements the single rank, open lines.

Organization by division, brigade, regiment, battalion and company, even though necessary for deployment, melts away in the ultimate conflict and is reduced to groups that can be led. Cohesion is given up, but coöperation remains. There can be unity of action if not uniformity of formation.

In the war of 1870–71 two main rules were ignored, so the author finds, neglect or insufficiency of reconnoissance on the part of Commanders-in-chief, and on the part of division and brigade commanders when having a separate task and the lack of preparation of attack by artillery, positions being visited on horseback *after the battle* rather than before.

It would not do to omit the view in these professional discussions, novel to us, that great generals of whatever nation have always been men of æsthetic tastes, with a love for the fine arts.

Possibly that accounts for the magnificent collection of pictures that Marshal

Soult added to his military baggage in Spain, and it may satisfactorily clear up the reputed devotion of Wellington to Mademoiselle Mars and other artistes in drama and song. Then there was that careful consul of old who exported a cargo of choice statues from Greece under contract with the skipper that if any were injured or lost they should be repaired and replaced at the cost of the carrier.

The freedom of treatment in this book can be judged from what is said of the action of the German cavalry leaders on page 364, and the remark, page 370, "In all military history there is hardly a battle where the subordinates as well as the superior leaders made so many tactical blunders as did the Germans at Gravelotte. The concentration of the armies before the battle was the greatest strategic feat accomplished, while in tactics the Germans did their very worst."

In the estimation of the author Napoleon still remains supreme. As compared with him the Germans failed above all in reconnaissance, in the use of artillery with its sequences, and in pursuit.

With regard to leading in battle the function of the Commander-in-chief is to assign to each battle unit its direction and objective, and keep in hand a reserve, everything else is the business of the tacticians or commanders of battle units.

But in battle leading there is to be no *orthodoxy* or overmuch clinging to prescription and regulation. The special capacity and the specially trained intelligence must exist and must be left to deal on its own initiative with the adaptation of principles to each individual case as it arises, and is isolated from all others by its own peculiarities of position, occupation and relation.

Infantry and artillery, it is said, have gained enormously in tactical value from the use of smokeless powders, and both at the expense of the cavalry, but well-led cavalry still has its opportunies as against the enemy's cavalry and in the pursuit and harvest of all the consequences following upon the moral and physical exhaustion of the other arms of service in the "fire-fight."

We have drawn very freely from the 414 pages of this book, and there is no page in it which is not worth quotation to illustrate how improvements in material have modified tactics and rendered necessary an advance all along the lines of every military acquirement and virtue.

There must be a wider reach of ability, a finer strain of courage, a higher training of body and mind, but it remains as true as ever that with all the improved methods and enlarged means success will belong, not to him who knows the most, but to him who can always make the best use of all that he knows.

That is the conclusion of a book which began with the text, "Wherever we may look we see good ideas finally degenerate into drill-ground fancies."

For every profession has its "bibliolatry" and its men who become the victims of phrases. *Courage fait tout*, was the slogan of the Empress Eugenie and the war party of 1870, and they went down in the wreck with that magnificent assertion.

H. W. C.

Notes on Military Hygiene for Officers of the Line.*

This little book gotten out in convenient form for the pocket, but printed in good sized clear type, contains the essence of lectures on Military Hygiene delivered at the Infantry and Cavalry School.

* *Notes on Military Hygiene for Officers of the Line.* A syllabus of lectures formerly delivered at the U. S. Infantry and Cavalry School by Alfred A. Woodhull, LL.D., Lieut.-Col. Med. Dept. U. S. Army. John Wiley & Sons, New York.

These lectures were chiefly compilations with additions, comments and illustrations drawn from personal experience. Parke's great work was the chief, but not the only source, whence principles were derived.

Though originally prepared for the convenience of student officers, this abstract should not only prove acceptable to officers of the Regular Army but to that larger body of Volunteers now training for active service.

In the revised edition now under notice, the text has been changed to correspond with the present army regulations and with the progress of sanitary science, and an essay has been added upon the care of troops in the field, especially in warm climates, which forms a timely expansion of the original matter.

The article on clothing is particularly interesting at the present time. Chapters on food, habitations, camps and marches, sewers and waste water, preventable diseases and asepsis for wounds follow in order, their titles showing the scope of the work and its general character.

The chapters on water and preventable diseases should be read by all officers.

Preparatory Battle Formations.*

A doubt as to how to attack a foe in position seems still lurking everywhere, writes Major May, and adds, that opinion with no recent war to solidify it, is still largely in a state of flux. It is not possible to arrive at a definite conclusion because the conditions of the problem keep varying as armaments are improved.

Among recent writers General Bengough presents an interesting pamphlet on Preparatory Battle Formations. The principle on which these rest consists of small columns composed of companies or half companies, or preferably sections, moving by fours at extended order interval, *i. e.*, a yard per man—the intervals between columns afford room for deployment.

The columns can be closed or opened out when passing through undulating country, thus avoiding exposure to view or to fire.

The formation is to be used in moving to the attack of a position in the near neighborhood of an enemy, but not under infantry or close artillery fire.

As regards the effect of artillery fire on small columns he writes that small columns of narrow front and shallow depth present a more difficult target than a line formation.

The General concludes his valuable suggestions with the remark: "What is required is a battle drill, to be practiced even more assiduously than barrack-square-drill. It is as a form of battle drill, not as a universal form or even perhaps the best possible form, but as a form founded on principle and applicable to a great variety of ground and of circumstance, that I submit this work to the judgment of practical soldiers."

Infantry Drill Regulations.†

The object of this little book is to bring out prominently by means of questions and answers every statement in the "Infantry Drill Regulations"

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* *Preparatory Battle Formations.* By Major-General H. Bengough, C. B. Gale and Polden, Wellington Works, Aldershot, England. Price one shilling.

† *Catechismal Edition of the Infantry Drill Regulations, United States Army.* Extended Order, prepared by Major Wm. F. Spurgin, 23d Infantry.

regarding "Extended Order," the numbers attached to headings denoting the paragraphs of the regulations.

The booklet should prove of much help both to instructor and student; it is clearly printed and of convenient form.

Private's Handbook of Military Courtesy and Guard Duty.*

The private of the National Guard or of Volunteers, often meets with doubts in referring to unabridged manuals for details, and a handbook for his individual guidance is of considerable assistance.

To company commanders, of whom our present conditions require prompt action in the training of new men, this book must prove of much worth.

The author has placed in convenient form the essential features of the subject which must be learned by the private in order to perform the duties that fall to his lot. Later, if he rise to the position of non-commissioned officer or officer, his knowledge of subordinate duties derived from this work will rest on a solid foundation.

With this object of aiding the inexperienced, certain paragraphs of authorized manuals and regulations of the United States Army are presented with supplementary paragraphs added in smaller type. These paragraphs serve to render the text clearer and help the learner over difficulties.

The booklet is printed in good clear type and in convenient form, and should prove of help to our volunteer recruits.

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* *Private's Handbook of Military Courtesy and Guard Duty.* By Lieutenant Melvin W. Rawell, United States Army. Hudson-Kimberly Publishing Co., Kansas City, Mo. 1898.

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Changes of address should be reported promptly.

Prize Essay—1898.

I.—The following Resolution of Council is published for the information of all concerned:

Resolved, That a Prize of a Gold Medal, together with $100 and a Certificate of Life Membership, be offered annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest, the subject to be selected by the Executive Council, and $50 to the first honorably mentioned essay. The Prizes will be awarded under the following conditions:

1. Competition to be open to all persons eligible to membership.

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1898. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate *the Essay deemed worthy of the prize;* and also in their order of merit those deserving of honorable mention.

In determining the essay worthy of the prize, the Board will be requested to consider its professional excellence, usefulness and valuable originality, as of the first importance, and its literary merit as of the second importance. Should members of the Board determine that no essay is worthy of the prize, they may designate one or more essays simply as of honorable mention; in either case, they will be requested to designate one essay as first honorable mention. Should the Board deem proper, it may recommend neither prize nor honorable mention. Should it be so desired, the recommendation of individual members will be considered as confidential by the Council.

4. The successful Essay shall be published in the Journal of the Institution, and the Essays deemed worthy of honorable mention shall be read before the Institution, or published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the JOURNAL (exclusive of tables).

II.—The Subject selected by the Council at a meeting held Sept. 11, 1897, for the Prize Essay of 1898, is

"OUR WATER BOUNDARIES AND OUR INTERIOR WATER-WAYS; HOW TO UTILIZE AND DEFEND THEM; THEIR INFLUENCE IN CASE OF INVASION."

III.—The gentlemen chosen by the Council to constitute the Board of Award for the year 1898 are:

REAR ADMIRAL BANCROFT GHERARDI, U. S. N.
BRIG. GENERAL WILLIAM P. CRAIGHILL, U. S. A.
HONORABLE JOSEPH H. OUTHWAITE.

GOVERNOR'S ISLAND,
Nov. 1, 1897.

JAMES FORNANCE,
Secretary.

Prize Essay of Infantry Society

FOR 1899.

"The Infantry of the United States Army. How Should it be Recruited, Equipped, Organized, Supplied and Utilized."

Essays should be in the hands of the Secretary and Treasurer, U. S. Infantry Society, Fort Leavenworth, Kansas, before January 1, 1899.

The conditions of the competition can be learned from the Secretary.

Announcement.

SO far as possible the JOURNAL will be sent to the members of the Service wherever they may be at the time of issue.

As it is impossible to locate *every* one of our members at *all* times, it is requested that we be advised of change of address.

Members who desire to have the JOURNAL sent to their *home* addresses are requested to send instructions to that effect.